Preface

Perhaps the most obvious challenge of medical profession begins during the training period. At one end there is the immense pressure of providing appropriate patient care while on the other hand it is the time for booming oneself as a physician with new procedures in practical experiences. Getting oriented with the lessons learned along with correlation of updated information and at the same time applying those in practice is the key to success of this novel profession. In spite of logistic and economic limitations, the trainee doctors of developing nations are always willing to be oriented with the latest technological development and apply them in their daily practice. At the same time due to the vast progression of medical science, several diagnostic and therapeutic procedures now presents with various diversified options in respect of providing better patient care. But limitations in sharing such information leaves the physicians with a shortcoming in proper patient care which ultimately puts an immense burden on the entire health care system.

To minimize such limitations, the Medical Department of Beximco Pharmaceuticals Ltd. took the venture of compiling a complete and standard guidebook highlighting certain important medico-diagnostic procedures. After the overwhelming response from the first edition of ‘Procedure in Practice’, we are delighted to introduce the second edition this year. The book aims at those doctors who recently joined the practical team of medical community as well as the trainee ones. Here we have updated the previous information as well as incorporated several of the modern procedures currently in practice. This handbook is a single volume detailed enough to be a valuable practical reference not only for the trainee doctors but also for the practicing physicians especially those providing care at rural centers. We therefore hope that this handbook will be of great help to those who are new in general practice and also the senior physicians may keep this guidebook for quick references.

Rabbir Reza
Chief Operating Officer
Beximco Pharmaceuticals Ltd.
Preface

The intervention procedures in clinical practice are very important for diagnostic and therapeutic aspects of patients. Certain of such procedures need to be addressed in the simplest way suitable for doctors who have just about to start their practical experiences. These trainee doctors as well as the rural practitioners sometimes require guidelines for invasive examination of patients. This book may be of need for senior practitioners to guide the trainees. Keeping such contexts in mind, we have previously published a guidebook on Procedure in Practice few years back. Due to the overwhelming response of its 1st edition, I am pleased to present the 2nd edition of the Procedure in Practice compiled and published by Medical Department of Beximco Pharmaceuticals Ltd. I am sure this book will be of great help to them. This is not only the compilations of the 1st edition but it also has been updated with modern available knowledge taken from electronic media. I hope this handbook will serve as a handy reference for medical professionals and students in their day to day life.

I like to thank the personnel of Medical Department, Beximco Pharmaceuticals Ltd. Who have given a lot of efforts to publish this handbook, and I believe this effort will benefit our young physicians and medical students.

Regards,

Dr. Selina Akhtar
Deputy General Manager
Medical Department
Beximco Pharmaceuticals Ltd.
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Arterial Puncture

Arterial puncture is essential to measure the arterial blood gas tensions, oxygen saturation and pH. An arterial blood gas sample reveals how well the lungs are functioning in terms of gas exchange. The composition of arterial blood is consistent throughout the body, while venous blood varies depending upon the metabolic needs of the body. The procedure is technically more difficult to perform, potentially more painful and hazardous than a venipuncture, and thus arterial specimens are not used for routine blood tests.

Indications

- The primary reason for performing arterial draws is to obtain blood for evaluation of arterial gases (ABGs). Arterial blood gas evaluation is used in the diagnosis and management of respiratory diseases (for example type I respiratory failure with a low PO$_2$ and normal or low PCO$_2$ and type II respiratory failure with low PO$_2$ and high PCO$_2$).

- It provides valuable information about a patient's oxygenation, ventilation and acid-base balance.

Sites of Puncture

For arterial puncture several sites can be used. However, the criteria for the selection include the presence of collateral circulation, size and accessibility of the artery and the type of tissue surrounding the puncture site. Commonly radial or brachial artery is used. But femoral artery can also be used in some circumstances. Other rarer sites from where arterial specimens may be obtained include the scalp, umbilical arteries and the dorsalis pedis in the adult. The site chosen should not be inflamed, irritated, edematous or close to a wound.

Radial artery enjoys the advantage of having collateral circulation. If collateral circulation is absent, the radial artery should not be used. The disadvantage of using the radial artery is considering its small size, and the skill level required to perform the arterial puncture successfully. Additionally, the disadvantage is compounded if the patient has low blood pressure.
**Brachial artery** is large, and easy to palpate and puncture. It has good collateral circulation, but not like the radial. The brachial artery is deeper than the radial, and lies close to the basilic vein and the median nerve. The most notable disadvantage is that there is no underlying ligaments or bone to support compression of the brachial artery, resulting in an increased risk of hematoma formation.

**Femoral artery** is also large and easy to palpate and puncture. Sometimes it is the only site where arterial sampling is possible, especially in patients with decreased cardiac volume. But it has a poor collateral circulation; and due to the location chances of infection is much greater, and maintaining aspect technique is too difficult. Furthermore, this site is embarrassing to the patient, inconvenient for the operator, and not infrequently yields blood.

**Contraindications**

Contraindications to arterial puncture include a bleeding diathesis, as for example a platelet count below 3×10¹⁰/l; and disturbance of clotting factors as in hemophilia and hypoprothrombinemia or after overdoses of anticoagulants such as heparin etc. In these conditions arterial puncture may lead to an excessive local hematoma formation, and this may also rarely complicate arterial puncture in patients with a diastolic blood pressure over 120 mm of Hg.

**Equipment**

- Povidone iodine and/or chlorhexidine are generally used
- If an anesthetic is preferred, a local of 0.5% lidocaine may be used. Without this, the patient may respond with breathing harder, holding the breath, crying or hyperventilating; all of which can affect the blood gas results. Administration of anesthetics may be omitted for patients who have had the procedure before and are not apprehensive about it
- Various sized needles can be used in accordance to the artery selection. A 22G one inch needle is most commonly used for radial and brachial punctures, whereas a 1.5 inch needle is used for femoral punctures
- 1-5ml syringes, depending on the amount of blood needed to perform the test, are required. There is special glass or plastic syringes, some containing heparin are sometimes used
- A rubber or latex block is used to insert the needle in after collection
• For transport back to the laboratory, a luer cap is used to cover the end of the syringe after the needle has been removed. This is to maintain anerobic conditions of the specimen.
• Lithium or sodium heparin is used to prevent clotting.
• A cool block is used to maintain the specimen at a temperature of 1°C-5°C.
• A 2x2 gauze pad is used to exert pressure over the site usually for about 2-5 minutes until bleeding has completely stopped.

Procedure

• The patient's temperature, respiratory rate and room temperature are recorded.
• The ABG syringe with heparin which is applicable is prepared, as follows-
  ♦ The free movement of the syringe is checked and a 20G needle is attached.
  ♦ The top of the heparin bottle is cleaned with alcohol.
  ♦ 0.5-1 ml heparin is drawn into the syringe. The plunger is pulled back on and is rotated at the same time to wet the entire barrel of the syringe.
  ♦ With holding the syringe vertically the majority of the heparin is expelled.
  ♦ The needle is replaced with another needle to be used to draw the blood sample.
• 0.5% lidocaine is drawn into a 1ml syringe using a 25G needle. The needle cap is placed over the needle and left it in a horizontal position.
• The patient's arm is positioned with the palm facing up. (A rolled towel or ‘draw pillow’ may be used for wrist support).
• Collateral circulation is checked by using Allen Test. For the test, the patient makes a tight fist so as to express the blood from the skin of the palm and fingers. The examiner performs digital compression on either the radial or the ulner artery. If on opening the hand blood fails to return to the palm and fingers, it indicates obstruction to the blood flow in the artery that has not been compressed.
• The patient is asked to make a fist. The radial artery on the thumb side of the wrist is located, but using the index and middle finger of the left hand. The artery is palpated to determine its size, depth and direction. The thumb is never used because it has its own pulsation and can be confused with the patients.
The site is cleaned by using alcohol first and then povidone iodine. Then it is allowed to dry carefully by not touching the site. No tourniquet is needed because of the pressure in the artery is sufficient to complete the draw. About 1ml of blood is drawn into a syringe that is kept on ice and transported to the laboratory as quickly as possible.

If an anesthetic is used, the skin is infiltrated over the selected site, entering the skin with the needle at about 10° with the surface of the skin. Then it is pulled back slightly on the plunger to check whether a vein is punctured (if a vein is punctured the procedure is performed again). Otherwise, the anesthetic is expelled into the skin forming a raised wheal. To take effect 1 to 2 minutes should be waited.

<table>
<thead>
<tr>
<th>Complication</th>
<th>Cause</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arteriospasm</td>
<td>May occur secondary to pain or anxiety</td>
<td>Reassure patient; explain procedure and purpose</td>
</tr>
<tr>
<td>Hematoma</td>
<td>Leakage of blood into tissue due to lack of sufficient elastic tissue to seal puncture site, especially in elderly.</td>
<td>Ensure using small diameter needle. Ensure proper technique in holding site 5 minutes post-puncture</td>
</tr>
<tr>
<td>Hemorrhage</td>
<td>Patient receiving anticoagulant therapy or patients with known blood coagulation disorders. Laceration of Artery.</td>
<td>Two minutes after pressure is released inspect site for bleeding, oozing or seepage of blood; continue pressure until bleeding ceases. A longer compression time is necessary</td>
</tr>
<tr>
<td>Sepsis</td>
<td>Infection/inflammation adjacent to puncture site.</td>
<td>Avoid sites indicating presence of infection or inflammation</td>
</tr>
<tr>
<td>Nosocomial Bacteremia</td>
<td>Inadequate cleansing prior to puncture</td>
<td>Ensure appropriate cleansing technique</td>
</tr>
<tr>
<td>Distal ischemia</td>
<td>No collateral circulation Clotting of Artery Lack of perfusion Necrosis of tissue</td>
<td>Only proceed with puncture after patient has a (+) Allen's Test</td>
</tr>
<tr>
<td>Numbness of hand</td>
<td>Nerve damage</td>
<td>Ensure proper technique. Palpate artery well, do not redirect when needle lies deep within tissue</td>
</tr>
<tr>
<td>Infection of Health Care Provider</td>
<td>Contact with virus, infections contained in blood of infected patients</td>
<td>Universal blood &amp; body fluid precautions should be implemented All blood samples from all patients must be treated with full precautions</td>
</tr>
</tbody>
</table>
• Then the drawing syringe is taken and the remaining heparin is expelled carefully but not drawing air back into the syringe. It is held in the dominant hand as like as holding a dart.
• The artery is located and needle bevel is inserted into the skin at about 45° angle, about 5-10 mm distal to the finger locating the artery. Needle is directed away from the hand with the bevel facing the flow of blood.
• As the needle is inserted slowly deeper into the wrist, it may be felt a 'pop' and a flash of blood will appear in the hub of the needle. At this point, further advancing the needle is stopped. The blood will be continued to flow into the syringe. It is not necessary to pull back the plunger. The syringe is held very still until the amount of blood needed has been collected.
• If the artery is missed, the needle is withdrawn slowly out to just below the skin and is re-inserted again. It is advised not to probe with the needle, as this can be very painful and can lead to a hematoma or thrombus formation and damage to the artery itself.
• After collection of blood the needle is withdrawn quickly, and immediately direct pressure is placed on the puncture site using a dry gauze pad. Any air bubble if suspected should be expelled immediately. Then it is placed in the rubber or latex square.
• After holding the pressure on the puncture site for 2-5 minutes, the syringe is removed from the rubber or latex square and the needle is replaced with the luer cap.
• The specimen is labeled and placed in ice or the cool block.

Complications

Problems with the Integrity of Arterial Blood Gases (ABG)

Air bubbles: If not removed immediately, O₂ from the bubbles can diffuse into the sample and CO₂ can escape, changing the results.

Delay in cooling: Blood cells continue to consume O₂ and nutrients and produce acids and CO₂ at room temperature. If the specimen remains at room temperature for more than 5-10 minutes, the pH, blood gases, and glucose values will change. Cooling between 1°C-5°C slows the metabolism and helps stabilize the specimen. Processing the specimen as soon as possible after collection will ensure the most accurate results.
Venous blood mixed in ABG sample: Sometimes it is difficult to distinguish between arterial and venous blood in patients with poor O$_2$ content. The best way to be certain that a specimen is arterial if the blood pulses into the syringe. In some cases, such as with low cardiac output, a specimen may need to be aspirated, when it is hard to be certain that the specimen is really arterial.

Improper anticoagulant: heparin is accepted anticoagulant for ABGs. Oxalates, ethylenediaminetetraacetic acid (EDTA) and citrates may alter the results.

Specimen Rejection

Arterial blood specimen may be rejected due to following factors:
- Inadequate volume of specimen for the test
- Clotted specimen
- Incorrect or no identification
- Using wrong syringe
- Delay in delivering the sample for analysis
- Not placed in ice
- Presence of air bubbles
Ascitic Fluid Tapping

Ascites is the intraperitoneal accumulation of free fluid. This fluid contains small amounts of protein, mesothelial cells and lymphocytes. Sodium, potassium, glucose are seen in the same concentration as in the blood. Complicated cases even show the presence of red blood cells and polymorphonuclear leucocytes. Cirrhosis is one of the most common causes of ascites but it can also occur in conditions such as infections, malignant disease, cardiac failure etc. Typical features are usually seen when the amount of fluid usually exceeds 700-1000ml. This may also be difficult to detect in obese people.

Common Features of Ascites

- Abdominal distension with fullness in the flanks
- Fluid thrill
- Shifting dullness on percussion
- Eversion of the umbilicus (upturned)
- Abdominal striae
- About 10-15% of patients exhibit right sided pleural effusion

Indications

The various indications for aspiration of ascitic fluid include:

- Marked abdominal discomfort and cardiorespiratory embarrassment
- Ascites refractory to medical therapy
- For diagnosing the nature of the ascitic fluid
- Ascites with anorexia, dyspepsia, hematemesis or oliguria
Contraindications

• Severe jaundice with impending hepatic coma
• Severe coagulopathy not correctable by vitamin K, fresh frozen plasma etc.
• Lack of patient's co-operation
• Pregnancy
• Distended urinary bladder
• Abdominal wall cellulitis
• Distended bowel
• Intra-abdominal adhesions

Recent literature suggests that the following factors are not contraindicated i.e., morbid obesity, low grade coagulopathy, multiple abdominal surgical scars and bacteremia

Pre-requisites

• Patient's informed consent
• The patient must be asked to evacuate the bladder
• Laboratory requisitions are completed in advance to avoid delay in fluid processing later
• Prothrombin and partial thromboplastin times prior to the procedure are ordered at physician discretion (some elect to transfuse fresh frozen plasma immediately prior to procedure if the parameters are prolonged)
• Antiseptic swab sticks
• Fenestrated drape
• Lidocaine 1%, 5-ml ampule
• Syringe, 10 ml
• Injection needles, 22 gauge (G), 2
• Injection needle, 25 G
• Scalpel, No. 11 blade
• Catheter, 8F, over 18 G x 7 1/2" needle with 3-way stopcock, self-sealing valve, and a 5-ml Luer-Lock syringe
• Syringe, 60 ml
• Introducer needle, 20 G
• Tubing set with roller clamp
• Drainage bag or vacuum container
• Specimen vials or collection bottles, 3
• Gauze, 4 X 4 inch
• Adhesive dressing
Equipment

- Sterile gloves
- Drapes (optional)
- Adequate local anesthesia (2% lidocaine with 26G needle)
- In clinical practice, various needles and angiocatheters are used. A 22G, 1.5 inch metal needle with a plastic catheter is recommended. If a thick panniculus is encountered, a 3-5 inch 22G needle may be substituted
- A sterile 50ml syringe and a sterile 1 liter vacuum bottle with connecting tube are also required if large volumes of ascites are to be removed

Procedure

Ascitic tapping or removal of ascitic fluid with the help of aspiration needle is a safe procedure. At first physician confirms presence of ascites by physical examination with patient in a semirecumbent position. Preferred site of entry is in the midline, inferior to the umbilicus. If a midline scar is present from previous surgery or if percussion is not reliable, an area near the flank is selected. At times, physician may request patient to assume the hand-knees position if small amounts of ascites are present. The entry site is then caudad to the umbilicus. The site is prepared with iodine solution and skin and deeper tissues are infiltrated with lidocaine. The skin is retracted caudally and the 22 G needle (attached to syringe) is inserted into the anesthetized area and advanced while aspirating. When ascites fluid returns freely, the needle is held in position and not advanced further (avoiding bowel trauma). Multiple
Aliquots (50ml) may be obtained in this manner. For larger volumes, the syringe is removed and connecting tube is directly attached to the 22G needle to allow drainage into vacuum bottles. Once the desired amount is collected, the needle is withdrawn quickly and the caudal skin retraction is released, allowing the skin to return to its normal position. This causes the entrance and exit needle sites to form a "Z-tract" which minimizes ascites leakage.

**Specimen**

When the procedure is performed therapeutically, the maximum volume of ascites that can be removed safely depends on the presence or absence of peripheral edema. It is recommended that in patients without edema, the upper limit should be 1500ml. Patients with peripheral edema may tolerate larger volumes without hypotension (in one study, ≤5 liter). When performed for diagnostic purposes, smaller volumes (50-100 ml) are adequate for routine studies. If malignancy or fastidious infection is suspected, larger volumes (more than 100ml) will improve laboratory yield.

**Investigations**

Ascites fluid is routinely analyzed for cell count and differential, chemistry, albumin and protein, Gram's stain, bacterial culture and cytology. Additional tests include special cultures for tuberculosis or fungi, ascites fluid pH, amylase, lipase, glucose, triglycerides, lactate and hyaluronic acid.
## Guide to Results of Laboratory Tests on Ascitic Fluid

<table>
<thead>
<tr>
<th>Source of ascites</th>
<th>Appearance</th>
<th>Protein concentration (g/l)</th>
<th>Total white cell count ((1 \times 10^9 / l))</th>
<th>Polymorphonuclear leucocytes (%)</th>
<th>Lymphocytes (%)</th>
<th>Amylase activity</th>
<th>Microscopy</th>
<th>Culture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uncomplicated cirrhosis</td>
<td>Clear</td>
<td>30 (occasionally high)</td>
<td>&lt;0.3 (occasionally high)</td>
<td>&lt;25</td>
<td>&gt;75</td>
<td>Low</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Neoplastic</td>
<td>Blood stained or clear</td>
<td>25 (sometimes low)</td>
<td>0.1-1.0</td>
<td>&lt;50</td>
<td>&gt;50</td>
<td>Low</td>
<td>May be positive</td>
<td>Negative</td>
</tr>
<tr>
<td>Pancreatic</td>
<td>Clear or serosanguinous</td>
<td>30</td>
<td>Variable</td>
<td>Variable</td>
<td>Variable</td>
<td>High</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>Clear-cloudy</td>
<td>30</td>
<td>Variable</td>
<td>&lt;50</td>
<td>&gt;50</td>
<td>Low</td>
<td>Positive peritoneal biopsy</td>
<td>Positive</td>
</tr>
<tr>
<td>Nephrotic</td>
<td>Clear</td>
<td>10</td>
<td>&lt;0.3</td>
<td>&lt;25</td>
<td>&gt;75</td>
<td>Low</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Cardiac</td>
<td>Clear</td>
<td>Variable (sometimes high)</td>
<td>&lt;0.3</td>
<td>&lt;25</td>
<td>&gt;75</td>
<td>Low</td>
<td>Negative</td>
<td>Negative</td>
</tr>
<tr>
<td>Spontaneous bacterial peritonitis</td>
<td>Cloudy</td>
<td>25</td>
<td>&gt;0.3</td>
<td>&gt;75</td>
<td>&lt;25</td>
<td>Low</td>
<td>Positive</td>
<td>Positive</td>
</tr>
</tbody>
</table>

- **Appearance**: Clear, Blood stained or clear, Clear or serosanguinous, Clear-cloudy, Clear, and Cloudy.
- **Protein concentration**: 30 (occasionally high), 25 (sometimes low), Variable.
- **Total white cell count**: 30 (occasionally high), 0.1-1.0, Variable, Variable, <0.3, Variable.
- **Polymorphonuclear leucocytes**: <25, <50, Variable, Variable, <25, <0.3.
- **Lymphocytes**: >75, >50, Variable, Hi, >75, >75.
- **Amylase activity**: Low, Low, Low, Low, Low, Low.
- **Microscopy**: Negative, Negative, Negative, Positive, Negative, Positive.
- **Culture**: Negative, Negative, Negative, Positive, Negative, Positive.
Normal Findings

Ascites fluid is traditionally categorized as either 'exudative' or high protein ascites or 'transudative' or low protein ascites based on laboratory analysis. Transudative ascites occurs in cirrhosis of liver, congestive cardiac failure, constrictive pericarditis, Budd-Chiari syndrome, inferior vena caval obstruction and nephritic syndrome. Exudative ascites (ascites protein >3g/dl) happens in malignancy, spontaneous bacterial peritonitis or other ascites due to infections (such as tuberculosis), vasculitis, pancreatitis and myxedema.

Aftercare

No special limitations exist for the patient postprocedure. If large amounts of ascites are removed (several liters), frequent blood pressure measurements are needed to monitor possible hypotension. Patients may ambulate post procedure if vital signs remain stable. Occasionally, ascites fluid may leak persistently from the puncture site; in this instance, the patient should remain supine with the site angled directly upwards, until the leak stops spontaneously.

Complications

- Peritonitis
- Fainting if the fluid is removed very rapidly
- Acute liver failure and precipitation of hepatic coma
- Perforation of viscus
- Protein depletion specially after repeated ascitic fluid tapping

Ascitic fluid tapping should not be performed to diagnose the presence of ascitic fluid. Prior to the procedure presence of ascitic fluid should be confirmed by physical examination or radiological imaging.
Aspiration and injection procedure for musculoskeletal conditions are generally safe, relatively easy to master, and produce few adverse effects. Often, arthrocentesis is performed for diagnostic purposes and joint and soft tissue injection is used for treatment. In general, both soft-tissue and systemic inflammatory conditions can be treated with injection but can be considered as an adjuvant to systemic and local treatment methods such as use of disease-modifying arthritic drugs and nonsteroidal anti-inflammatory drugs, use of hot and cold compresses and splints, rest, exercise, and physical and occupational therapy.

**Indications**

- Diagnostic aspiration in cases of suspected septic arthritis, crystal induced synovitis and hemarthrosis
- Therapeutic aspiration for tense effusions, septic effusions and hemarthrosis
- Therapeutic injections of corticosteroids for persistent localized synovitis or soft-tissue lesions
- Introduction of contrast media for diagnostic arthrography

**General Procedure**

Proper informed consent should be obtained from every patient before a needle insertion. Diagnostic aspiration or injection is much easier when appreciable swelling is present, as less precision is required in placing the needle. Before starting, the bony margins of the joint space should be felt carefully. The thumbnail should be used to mark the joint space, and if in doubt one bone should be moved so that its movement on one side of the joint can be felt. All necessary prerequisites should be ready: needles and syringes, local anesthetic (or saline), requisite specimen containers and, for large effusion, a jug or basin.
The skin should be prepared carefully with chlorhexidine in 5% spirit or surgical spirit—not savlon. A rigorous non-touch technique is for the experienced and for simple injections, and sterile gloves and sterile packs are for the less experienced. With experience it is rarely necessary to use local anesthetic, and a subcutaneous bleb is usually sufficient. Local anesthetic in the syringe is useful when difficulty in entering the joint is expected or the needle is to be cleared and checked that there is free and easy flow once the joint is entered. A topical anesthetic may be applied if desired to lessen patient's discomfort and anxiety. Often, a small quantity of 1% or 2% lidocaine hydrochloride is injected subcutaneously to provide local anesthesia. Some physicians mix a small quantity of 1% or 2% lidocaine with the corticosteroid preparation to provide temporary analgesia at injection site.

In joint aspiration the needle size is important. For thick, purulent or chronic effusions a 19G needle is usually needed, otherwise a 21 G needle will suffice. For finger and toe joints a 23G needle should be used which is usually used for injecting small quantities.

After aspiration, synovial fluid sample should be sent for analysis including blood cell count, Gram's stain and crystal analysis. When effusions are purulent, specimens should be sent for microbiological examination, measurement of protein and glucose concentrations (in a small fluoride container), and a heparinized sample for cytology and crystal examination. Identifying crystals require some experience, and at night it may be best to keep a sample refrigerated to be re-examined the next morning.

**Site-Specific Techniques**

Several site-specific techniques are described in the following. In all cases, the site of aspiration or injection should be prepared before the procedure is performed.

**Shoulder**

The shoulder joint is most easily entered anteriorly for aspiration, frozen shoulder, and synovitis. With the patient seated and his arm relaxed against the side of the chest, the space between the head of the humerus and the glenoid cap should be felt, about 1cm below the coracoid process. If in doubt, the humerus should be
rotated by moving the extended hand outwards and feel the head moving under the fingers. The needle is inserted into the space with a slight medial angle. It should enter the joint easily, almost to the length of a 21G needle. The usual dose is 25-50mg hydrocortisone acetate.

The lateral approach is used mainly for subacromial bursitis or the arc syndrome. The lateral tip of the acromion is felt and the needle is inserted just below in a medial direction with a slight downward slant until the tip reaches the humeral head. Gradually the needle is withdrawn with gentle pressure on the plunger. When the needle point is in the subacromial bursa, a sudden drop in resistance will be felt. Injection will often reproduce the symptoms of the painful arc syndrome; if it does not, the needle is angled in different directions until the pain is reproduced. Mixing local anesthetic with the steroid is a useful diagnostic test, as the shoulder movements (or symptoms) should be improved after a few minutes. A second injection after a few days is often required.

Bicipital tendinitis is one cause of shoulder pain and is detected by finding tenderness over the tendon when the arm is externally rotated. The needle should be inserted almost parallel to the tendon with 25mg hydrocortisone acetate into the tendon sheath and 25mg directly into the shoulder joint, as part of the tendon is intra-articular.

In rotator cuff tendinitis and shoulder impingement syndrome injection in the subacromial space is one of the most commonly performed techniques in primary care setting. The technique can also be used diagnostically to differentiate between local (shoulder joint) and referred (cervical spine) pain.

**Knee**

The pes anserine bursa is a common site of irritation that results in painful tendinitis or bursitis. The bursa is located along the medial aspect of the knee joint about 2cm below the medial joint line. With the patient in either supine or seated position, the point of maximal tenderness should be palpated. Typically, this is 2cm inferior to the medial joint line at the insertion of Sartorius, gracilis and semitendinosus muscles. After anesthetizing the skin, the needle should be inserted slowly until it gently contacts bone. The needle is then withdrawn 2-3mm and corticosteroid is injected.
The prepatellar bursa which is superficial to the patella between skin and patella often becomes irritated and easily palpable when swollen. Aspiration from swollen bursa can provide symptomatic relief and is required for fluid analysis. Corticosteroid injection is not recommended as a first line treatment for prepatellar bursitis to avoid subcutaneous tissue atrophy and fistulous tract formation.

The patient should be in the supine position for this procedure. If a local anesthetic is used, infiltration to the bursa should be done after raising a subcutaneous wheal. The patella should be stabilized with one hand and the needle should be directed at a 45° angle into the bursa by using the other hand. Any fluid should be aspirated, using the non-dominant hand to stabilize the patella and the bursa should be 'milked'. After the fluid has been removed, corticosteroid is injected with the two-syringe or Z-tract technique.

Intra-articular aspiration or injection of the knee is indicated to obtain fluid for analysis, to treat painful osteoarthritis, or relieve a tense effusion. The patient may be seated or in the supine position, with a bump or roll placed under the knee to slightly flex the joint.

The superior lateral aspect of the patella should be palpated and the needle should be inserted into the space between the patella and femur parallel to the inferior border of the patella. The needle should be angled to the center of the patella and fluid is aspirated before performing the injection. To obtain the most aspirate, the free hand should be used to milk the suprapatellar spaces. While an assistant clamps the needle at the hub with a sterile hemostat, leaving the needle in the intra-articular space, the syringe used for aspiration is exchanged with the one containing medication. After delivering the medication, needle should be withdrawn.

Hand and Wrist

De Quervain's tenosynovitis is a painful condition of the thumb and wrist that can be treated with a corticosteroid injection. With the patient's thumb in abduction, the point of maximal tenderness should be palpated along the abductor or extensor tendon. Injection should be delivered into the peritendinous space at the point of maximal tenderness done at a 45° angle, aiming away from the hand. Bending the needle at the hub may
make it easier to follow the course of the tendon. Injection is indicated for treatment of carpal tunnel syndrome when less invasive treatments are unsuccessful. The technique is fairly simple with the palmar surface of the hand facing upward; injection should be done just proximal to the flexor crease and just ulnar to the Palmaris longus tendon. The needle should enter the skin at a 45° angle and be aimed toward the tip of the middle finger. The needle is advanced 1-2cm until resistance is felt. To ensure that the needle is in the tendon, the patient is asked to make a fist slowly and the needle should move back and forth. After withdrawing the needle slightly, medications should be injected. A dorsal ganglion of the wrist that has become painful or irritated may be aspirated and injected. After raising a subcutaneous wheal with lidocaine hydrochloride, the skin and soft tissues are infiltrated. Inserting the needle directly into the ganglion, any fluid should be aspirated. Aspiration may be difficult if the fluid is very thick. If the cyst needs to be injected, a sterile hemostat is needed to stabilize the needle while attaching and injecting the syringe containing the medication. It is often helpful to apply a compression dressing after this procedure.

Elbow

Injection has been shown to provide short-term relief in lateral epicondylitis when less invasive treatments have failed. After palpating the lateral epicondyle, a point is needed to be identified 1cm superior and 1cm distal to the lateral epicondyle and medication should be injected. This area may be quite sensitive, so caution should be taken not to strike bone. To infiltrate a broad area the needle should be withdrawn and redirected repeatedly. Although more conservative measures can be attempted, many physicians offer injection as a first line treatment. Aspiration and injection in treatment of olecranon bursitis closely parallels with that of treatment of prepatellar bursitis. Again, caution should be taken with corticosteroid injection, as the olecranon bursa is fairly superficial and can become infected. The two-syringe or Z-tract technique should be used. Infiltration of skin and soft tissues should be done with anesthetic after raising a subcutaneous wheal with lidocaine. The needle is injected directly into the bursa and fluid will come out. The non-dominant hand may be used to milk the fluid. Follow-up injection with corticosteroid is controversial but may be given if the fluid does not appear infected on gross examination.
Hip

_Bursitis of the greater trochanter_ is painful and often responds well to corticosteroid injection. Anesthetic injection is also useful to differentiate between local and referred pain. The patient should lie on the unaffected side and the point of maximal tenderness over the postero-inferior edge of the greater trochanter is to be identified. The needle should be advanced until it gently contacts bone. Withdrawing the needle about 0.5cm a partial injection should be given. The remaining medication should be infiltrated into the surrounding area by alternately withdrawing and redirecting the needle.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Normal</th>
<th>Non-inflammatory</th>
<th>Inflammatory</th>
<th>Septic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Clear</td>
<td>Straw yellow</td>
<td>Yellow</td>
<td>Variable</td>
</tr>
<tr>
<td>Clarity</td>
<td>Transparent</td>
<td>Transparent</td>
<td>Hazy opaque</td>
<td>Opaque</td>
</tr>
<tr>
<td>Viscosity</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>Low-high</td>
</tr>
<tr>
<td>White blood cell count (per mm$^3$)</td>
<td>0-200</td>
<td>200-2000</td>
<td>2000-75000</td>
<td>&gt;50000</td>
</tr>
<tr>
<td>Neutrophils (%)</td>
<td>Low</td>
<td>Low</td>
<td>Medium-high</td>
<td>High</td>
</tr>
</tbody>
</table>

Foot

_Plantar fasciitis_ may be treated with an injection, although it is typically not considered as a first line treatment for the painful condition. The medial approach is recommended to minimize potential damage to the fascia on the fatty heel pad. Patients's foot should be placed with the medial (tibial) side upward. After palpating the area between the calcaneus and the fascia, the needle is inserted into the space with care to avoid the plantar fat pad.
Trigger point

Trigger point injection may be used to treat many painful soft tissue conditions. 1-2ml saline solutions, 1-2ml lidocaine, or 1ml triamcinolone may be used. If injecting a corticosteroid, care should be taken not to inject it too superficially (<5mm) because of the risk of subcutaneous fat atrophy. The trigger point should be identified and injection is given directly into the affected tissue using a 1-1.5 inch 25G needle on 3ml syringe. The area should be infiltrated by repeatedly withdrawing the redirecting the needle in a 2cm circle.

Cautions

Frequent use of steroid injections in weight-bearing joints, particularly in osteoarthritis, is not recommended, and the interval between injections should not be normally less than three months. The patient should be warned not to be overenthusiastic in using the joint within 24 hours after injection. If septic arthritis is suspected or the joint fluid is purulent, steroids should not be injected until negative bacterial cultures have been obtained. The possibility of tuberculosis as a cause of ‘synovitis’ must be considered. Iatrogenic infection is rare with disposable syringe and needle, and the risk is minimized by a careful sterile technique. The patient should nevertheless be warned to seek medical advice for increased pain or swelling after intra-articular injections. Certain soft-tissue injections, particularly for tennis elbow and painful arc shoulder, may cause increased pain for a day or two afterwards, and the patient should be warned of this before injection.

Summary

Joint and soft-tissue injection can augment systemic and local conservative treatment and have long-lasting benefits. Inflammatory and crystalline arthritis, synovitis, tendinitis, bursitis, and many other conditions respond well to injection. Corticosteroid preparations should be chosen on the basis of solubility and should not be made directly into a ligament or tendon. With usual attention in corticosteroid use and avoidance of contraindications, safe and effective long-term therapy can be provided.
Bone Marrow Aspiration and Trephine Biopsy

Bone marrow is one of the body's largest organs, representing 3.5-4.5% of the total body weight. Bone marrow aspiration is a procedure in which a sample of bone marrow is removed with a special needle. Then the sample can be examined with a microscope to look for various diseases or conditions. Bone-marrow fragments may be aspirated and spread on slides, as for a blood film; or a core of bone and marrow may be obtained intact and histologically sectioned (trephine biopsy). Bone marrow examination is an essential investigation of many hematological disorders. It may provide a diagnosis suspected from the clinical features and peripheral blood examination or occasionally gives a previously unsuspected diagnosis. It is also useful in certain diseases for assessing the extent of the diseases or the degree of response to treatment. In general, aspiration is used to show the morphology of individual hematopoietic cells and to obtain material for ancillary tests, whereas a trephine biopsy gives a more representative view of the cellularity of the marrow and allows infiltrations to be recognized.

**Needles Used for the Procedure**

Aspiration needles (the Salah or Klima) are short and stout, should have a sharpened bevel, a well-fitting and easily removable stylet, and an adjustable guard for use in sterna aspirations. For a trephine biopsy the Jamshidi-Swain needle is favored. This has a radially tapered distal cutting tip, which prevents the specimen from being crushed or plugged in the needle.

**Sites of Aspiration**

*Sternum:* It is the easiest site for aspiration. To obtain the most cellular marrow, usually the second or third intercostals space just to one side of the midline is chosen in semirecumbent or supine position. But it causes the greatest patient apprehension. This site should be used only for patients over 12 years old.

*Posterior iliac crest:* usually the uppermost crest is used. The patient is placed in the right or left lateral position with the back comfortably flexed. This site can be a difficult landmark to find in an obese patient, but several attempts to obtain marrow can be made in the same area. It may be used for any patient over 1 year old.
## Indications for Bone-Marrow Aspiration and Trephine Biopsy

<table>
<thead>
<tr>
<th>Clinical conditions</th>
<th>Bone marrow aspiration*</th>
<th>Ancillary tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unexplained anemia (particularly when reticulocyte count is low)</td>
<td>Deoxyuridine suppression tests</td>
<td></td>
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<tr>
<td>macrocytic anemia (to distinguish megaloblastic from normoblastic erythropoiesis)</td>
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<tr>
<td>Granulocytopenia or thrombocytopenia or both (to distinguish failure of production from peripheral consumption)</td>
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<tr>
<td>Suspected acute leukemia (and to monitor treatment) and myelodysplastic syndromes</td>
<td>Cytochemistry, cytogenetics, electron microscopy, cell surface markers, enzyme assays, semi-solid agar culture</td>
<td></td>
</tr>
<tr>
<td>Suspected myeloma, Suspected lipidoses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis of certain infections for example, tuberculosis, kala-azar</td>
<td>Appropriate microbiological culture</td>
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<tr>
<td></td>
<td><strong>Bone marrow aspiration and trephine biopsy</strong></td>
<td></td>
</tr>
<tr>
<td>Panctopenia-for example, aplastic anemia, hypersplenism</td>
<td>Cytogenetics (in chronic granulocytic leukemia)</td>
<td></td>
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<tr>
<td>Chronic leukemia</td>
<td>Cytogenetics</td>
<td></td>
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<tr>
<td>Myeloproliferative diseases-for example, polycythemia, thrombocythemia, myelosclerosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspected infiltration by for example, lymphoma, carcinoma, granuloma. If repeated 'dry taps' on attempted aspiration, trephinement is done</td>
<td>ImmunoFluorescence or immunoperoxidase studies in non-Hodgkin's lymphoma</td>
<td></td>
</tr>
</tbody>
</table>

*Routine stains are Romanowsky’s (for example, May-Grunawald, Giemsa) and iron; results available in one to two hours

**Routine stains for the trephine biopsy are hematoxyline, eosin and reticulin; results available in seven days (unless rapid decalcification used)
Anterior iliac crest: It may be used in adults with the patient in supine position. A site is chosen 2.5-5cm posterior to the anterior superior iliac spine and beneath the palpable lip.

Tibia: For use in children less than 1 year old. The flat triangular area at the proximal end of the medial surface of the tibia, just below the tibial tubercle, is chosen.

Trephine biopsy should be undertaken only at the posterior iliac crest, and since both an aspirate and a trephine biopsy specimen are often necessary, this site is commonly used. Biopsy specimens may, however, be taken from other sites for example, where an X-ray film or bone scan suggests a definite lesion.

Procedure

In adults no special preparation is necessary. But for infants and children the physical and psychological preparations can be preceded for this test that can reduce the child's anxiety, encourage co-operation and help develop coping skills.

Technique of Aspiration: A clean, non-touch technique should be used. Sedation is not usually needed except for children and apprehensive adults. The patient is positioned appropriately for the site chosen and the area is cleaned with chlorhexidine or iodine and surrounded with sterile towels. The feed and the overlying skin and periosteum are infiltrated with up to 5ml of 2% plain lignocaine. The needle should be sharp, the stylet be easily removable, and the guard mobile. For iliac crest and tibial
procedures the guard may be removed. With one hand identifying the landmarks and keeping the overlying tissues taut, the needle is pushed through the skin and subcutaneous tissues. For stern aspiration the guard should be adjusted when the periosteum is reached, so that only further 5mm advancement is possible. The needle is held at right angles to the bone and with firm pressure and a clockwise-counter-clockwise action the needle is pushed through the outer cortex until a sensation of decreased resistance is felt when the marrow cavity is entered. The stylet is removed and a 10 or 20ml syringe is attached to the needle. With gentle suction up to 0.5ml of marrow is aspirated into the syringe for morphological examination. Any greater volume will result increasing contamination with peripheral blood. A second volume may be aspirated into another syringe for ancillary studies. If no marrow is aspirated, the needle is rotated or the stylet replaced and the needle cautiously advanced or retracted. If marrow is still unobtainable, a different site together with a clean needle should be used and possibly a trephine specimen taken.

Preparation of Bone Marrow Slides: It is a technique that requires practice, and badly made films render the aspirate uninterpretable. Smears must be made promptly before it clots. A technician may be needed to make the films or if necessary, the sample may be placed into EDTA for a few minutes until the laboratory is reached. A
pediatric tube should be used to avoid an excess of anticoagulant. When marrow films are prepared a drop of the aspirate is placed 1 cm from the end of a clean slide. Excess blood is aspirated with a Pasteur pipette or a second needle and syringe leaving marrow particles behind. Some workers concentrate all the particles on a separate slide or watch glass. By using a second smooth slide or spreader, a 3-5 cm film is made from the particles in the same manner as for peripheral blood. The particles should leave a trail of cells. At least eight slides should be available for staining. Romanowsky's and iron slides may be needed. Additional material should be put in the appropriate medium with an anticoagulant for special tests.

*Jamshidi-Swain Trephine*: The patient is positioned and prepared as for posterior crest aspiration. The skin overlying the crest is incised with a scalpel blade, or the sight of entry of a previous aspiration is used. With the handle of the needle grasped in palm of the hand and the stylet locked in position the needle is pushed through the subcutaneous tissues until it reaches the posterior crest. It is then slowly advanced with firm pressure in an alternating clockwise-counter clockwise motion in the direction of the anterior superior iliac spine until a sensation of decreased resistance is felt. The stylet is removed and the needle further advanced until 2-3 mm and with less pressure advanced 2-3 mm further in a different direction, which breaks the specimen at the distal cutting edge of the needle. The instrument containing the biopsy sample is then withdrawn by rotation along its axis with quick full twists. The specimen is removed from the needle by introducing the probe through the distal cutting end. The biopsy can be dabbed on or rolled across a slide before being placed into fixative for routine staining. After decalcification sections are stained routinely with hematoxylin, eosin or reticulin.
Risks

In severe coagulation disorders (for example, hemophilia, severe disseminated intravascular coagulation) the procedure should be undertaken only when the defect has been corrected by appropriate plasma fraction replacements. A trephine biopsy in such conditions might give rise to prolonged hemorrhage. Thrombocytopenia alone does not usually present as a major problem. Failure to use the guard during performing sterna aspiration could give rise to complete penetration of the bone with a resultant fatal hemorrhage, pericardial tamponade, mediastinitis, or pneumomediastinum. Local sepsis is extremely rare except in patients with severe neutropenia, for whom sterile precautions should be taken. Furthermore the investigations are sometimes limited by the small size of the samples and consequent sampling errors. Infiltrations may be missed, and the cellularity may vary from site to site.

Aftercare

After the procedure a plaster is applied, and firm pressure over the site for a few minutes is recommended (for longer if the patient has a hemostatic defect). Pain management may be done when the numbing medicine wears off. Finally, though the procedure is uncomfortable, can be tolerated by both children and adults.
Kidney Biopsy

A kidney biopsy or a renal biopsy can help find a diagnosis and determine the best course of treatment. However, needle biopsy provides sample of only about 20 of the 2000000 glomeruli, so it is unhelpful and may give misleading results in patchy conditions such as chronic pyelonephritis. It is most valuable in assessing and, in particular, indication the prognosis of patients with diffuse glomerular disease.

Renal biopsy is 'not useful' in evaluating

- Malignant hypertension
- Polycystic kidney disease
- Hepatorenal syndrome
- Pyelonephritis
- Chronic renal failure with shrunken kidneys
- Routine cases of diabetes nephropathy

<table>
<thead>
<tr>
<th>Principal Indications for Kidney Biopsy</th>
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<tbody>
<tr>
<td>Clinical syndrome</td>
</tr>
<tr>
<td>Asymptomatic proteinuria</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Recurrent isolated hematuria</td>
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<tr>
<td></td>
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<tr>
<td>Acute nephrotic syndrome</td>
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<tr>
<td>Nephrotic syndrome</td>
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<td></td>
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<tr>
<td>Acute renal failure</td>
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<td></td>
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<tr>
<td>Chronic renal failure</td>
</tr>
</tbody>
</table>
Contraindication

- Inadequate contralateral kidney
- Only one kidney
- Hemorrhagic tendency
- Platelet count $< 10 \times 10^{10}/l$
- Prothrombin times $> 16$ sec.
- Shrunken kidneys

Special Instructions and Considerations

- Any nonsteroidal anti-inflammatory drugs (NSAIDs) including aspirin and ibuprofen should be discontinued 10-14 days before the test, as these drugs impair the clotting ability of blood.
- Screening for any clotting disorder should be done. If there is any clotting problem, patients may be admitted to the hospital the evening before the biopsy for treatment to diminish this, or the biopsy may be cancelled.
- Urine R/M/E should be done to exclude urinary tract infection.
- On the day of biopsy, patient may fast to avoid any potential stomach upset that sometimes accompanies anxiety about the procedure.

Procedure

Biopsy should not be done on shrunken kidneys because they are difficult to locate, the histology is often non-specific, and in any case, the result is unlikely to provide information of any therapeutic relevance. Premedication with intravenous diazepam makes the procedure less unpleasant for the patient. General anesthesia is required only for infants and young children. A firm surface is needed, so bed boards under the mattress are required. The patient is placed in prone position with his head turned away (most patients do not want to watch), his arms abducted, and his forearms beside his head. A rolled-up towel (about 10 cm in diameter) is put under the patient's abdomen between the rib cage and pelvis. Preferred site is the center of the lower pole of the left kidney. This avoids the major renal vessels and is likely to contain more cortex than medulla. On an intravenous urogram film the distance of this point from the lumbar spinous processes is measured. The bony landmarks are the tips of the dorsal processes of the lumbar spine and lower border of 12th rib. These are palpated and marked.
on the patient's skin. Then a line is drawn vertically downwards from the 12th rib at distance from the spine. Measuring the length of on the X-ray film is unreliable because of radiological distortion, so a site along B, 2cm below the lower border of the 12th rib is chosen. If there is failure to locate the kidney, the physicians must go higher. Ultrasound examination gives more accurate localization of the kidney but is unnecessary in most cases.

Wearing sterile gloves and standing at the left side of the patient, the skin is prepared and the skin and subcutaneous tissues are locally anesthetized. Then a 17cm, 1.1mm (19G) exploring needle is inserted into the lumbar muscles and then advanced 5mm at a time until a definite swing with respiration shows that the point is within the kidney. The patient is asked to hold his breath in inspiration each time the needle is moved and to take a deep breath out and in after each advance. The needle should be handled only while he is holding his breath. The kidney is about 5-8cm deep; after locating it, local anesthetic is injected along the track while withdrawing the needle.

To take a biopsy specimen the Vim-Silerman needle, with the Franklin modification, and the Tru-Cut disposable needle are equally effective. Here the Tru-Cut technique will be described. The 11.4cm needle is suitable for most patients, but for larger patients the 15cm one is used.

A nick in the skin is made with the point of a scalpel blade and then the biopsy needle is advanced, with the cannula closed over the obturator, stepwise as with the exploring needle. A large arc of swing usually shows that the kidney has been located, but care is taken of the patient who uses his chest more than his diaphragm when asked to breathe deeply.

When the swing is small it is easy to penetrate the full thickness of the kidney, and the specimen obtained will comprise of only fat or blood clot. In these patients, correct location of the point of the needle depends on feeling the resistance of the capsule on penetrating it. The disposable needle is sharp and the change in
resistance slight, so, for sensitive control, it is held low down by the shaft rather than by its handle. Another indication of reaching the kidney is the transmission of arterial pulsation. A small jerk with each respiratory movement means that the tip of the needle is just cramping the capsule and should be advanced a little further. If the needle moves only at the extreme of inspiration it is probably being struck by the lower pole and should be reinserted higher up.

When satisfied that the tip is just within the kidney the patient is asked to hold his breath in inspiration. The obturator handle is tapped in, the cannula is pushed smartly down the length of its travel to cut the specimen, keeping the obturator handle firmly fixed with the other hand, and finally the needle is withdrawn with the cannula closed over the obturator. The last three manoeuvres must be made while the patient is holding his breath.

A successful biopsy produces a strip of kidney up to 20mm long. Immunofluorescence microscopy is carried out on fresh tissue, while routine and electron microscopy require appropriate fixatives. When all these techniques are available the specimen must be divided into three, so each part is examined with a hand lens or dissecting microscope and be sure that all the parts contain glomeruli. If there is any doubt about their adequacy, another specimen is obtained rather than the risk of having to repeat the whole performance later when receiving histology report reading ‘medulla only’. The patient should remain in bed for 24 hours and have his pulse and blood pressure checked hourly for four hours and then at four-hour intervals.

**Aftercare**

- Patient should be kept in bed for several hours after the biopsy to prevent excessive internal bleeding or should be admitted to the hospital to monitor possible bleeding
- Blood pressure should be monitored frequently because a drop can indicate abnormal bleeding
- Few patients may experience red urine in the first 24 hours or so (this is not a sign of excessive bleeding)
- The blood count and blood pressure should be checked 12-24 hours after biopsy. If they are stable, patient may be discharged
- Patient must avoid any ‘bouncing activity’ (e.g., aerobic exercise, jogging, tennis or bouncing when coming down stairs) for two weeks so that the small blood clot that temporarily forms over the biopsy site does not become dislodged
- Any abdominal pain or pain that radiates down into the groin should be reported to the doctor. However, mild aching and discomfort in the loin area (due to irritation of the back muscles) is typical and not a cause for concern
Complications

The most important complication is hemorrhage. It may be perirenal, causing loin pain and in some instances a palpable mass as well as it may be intrapelvic, causing persisting heavy hematuria and sometimes clot retention. Sometimes signs of hemorrhage are evident. More minor hematuria is common and usually settles quickly. Continuing hemorrhage should be treated by blood transfusion and sedation. Exploration of the kidney is only rarely required.
Liver Biopsy

Liver biopsy is a bedside procedure valuable in different types of liver diseases and systemic illness. The indication for, and methods of liver biopsy have been changed over the past few years with the advent of new imaging techniques and the development of new indication of biopsy.

A blind procedure in a vascular organ like the liver can be hazardous, so physicians should be well prepared and rehearsed. Practice with an appropriate instrument may be got in the necropsy room, but there is no substitute for learning by watching and copying someone who performs liver biopsies every week.

Erlich is credited with the first liver aspiration in 1883 and subsequently the first percutaneous liver biopsy for diagnostic purposes was reported in 1923. It is a simple procedure that provides a core of tissue for laboratory investigation and currently the best way to determine the amount of liver damage; however the procedure is not specific. Several different instruments are available for liver biopsy, each with its own technique. The general principles apply to all, but our discussion of procedure is confined to the disposable Tru-cut needle. The Tru-cut needle procedure provides less fragmented specimen, even in the cirrhotic liver. However, dwell time in liver is longer (5-10 seconds). Other needle procedures like Menghini and Vim-Silverman needle are also available. Of them Menghini needle procedure requires only one second to reach within the liver and patients need not hold his breath. The only main disadvantage is fragmented small specimen. Liver biopsy may also be carried out at laparotomy, through laparoscopy and transvenously.

Types of Liver Biopsy

Percutaneous liver biopsy: percutaneous liver biopsy may be classified according to the site of entry of the biopsy needle, whether the biopsy is performed in a blind or guided manner or whether the biopsy track is plugged after the procedure.
Transthoracic (transpleural or transparietal) and subcostal liver biopsy: In this type in majority of the cases intercostal space in the midaxillary line just cephalad to the costal margin is used. If the patient has an enlarged liver extending below the costal margin, then the site of entry of the biopsy needle may be subcostal. Complications are slightly more frequent with the transthoracic than the subcostal route.

Blind and guided liver biopsies: A blind liver biopsy is one which is done without imaging of the liver immediately prior to taking the biopsy sample. A guided biopsy can be defined as a live biopsy that is undertaken during imaging of the liver by ultrasound, computed tomography (CT) or magnetic resonance imaging (MRI). It provides easy access to thicker hepatic parenchyma, avoids puncture of adjacent organs and provides accurate biopsy of focal hepatic lesions where appropriate. The use and evidence for image guided liver biopsy is controversial.

Plugged liver biopsy: Plugged liver biopsy is a modification of the percutaneous approach which was first described in 1984. It has been advocated as an alternative method for obtaining liver tissue in patients with impaired coagulation where transjugular biopsy is not available. In this technique a biopsy sample is taken using a Tru-cut needle in the conventional manner but only the obturator containing the specimen is removed leaving the outer cutting sheath within the liver substance. A plastic cannula is then inserted down the sheath and while the breath is still held in expiration, gelatin or gelfoam is injected as the sheath is withdrawn.

Transvenous (Transjugular) Liver Biopsy: Transvenous liver biopsy was first described in 1964. It has been used in disorders of coagulation commonly in patients with liver disease, in significant disturbance of clotting, and to avoid percutaneous liver biopsy because of the risk of bleeding. This is usually done through a transjugular approach but may rarely be done via a transfemoral route. It is performed in a vascular catheterization laboratory with video-fluoroscopy equipment and cardiac monitoring because of the risk of cardiac arrhythmia as the catheter passes through the right atrium. The internal jugular vein is (usually) cannulated on the right side and a sheath inserted via a Seldinger technique. A 45 cm long catheter is then guided under fluoroscopic control through the right side of the heart to the inferior vena cava. The catheter is then loaded with the
transvenous biopsy needle and advanced into the hepatic veins and the position checked by injection of contrast medium. The needle is then advanced rapidly 1-2 cm past the tip of the catheter with the patient holding breath and the liver tissue is retained in the needle while it is inside the liver.

Laparoscopic liver biopsy: This technique is well established and has also been used in centers where access to transvenous liver biopsy is not available, in patients with abnormal clotting parameters, patients having a combination of a focal liver lesion and a coagulopathy where a histological diagnosis is essential in the management of the patient.

**Indications**

- Confirmation of a clinical diagnosis of cirrhosis
- Investigation of chronic hepatitis and merit of the effects of treatment
- Histological confirmation of primary and secondary tumors
- Investigation of 'difficult' jaundice like hepatitis C
- Investigation of the effects of drugs, including alcohol, on the liver
- Occasionally in acute hepatitis and hepatomegaly, and when liver function tests give abnormal results that remain unexplained
- As an aid to diagnosing undetermined origin granulomatous disease and lymphomas
- Raised serum ferritin or suspected copper metabolic disorder
- Remains part of the investigation of pyrexia of unknown origin (PUO) and storage disorders
- Often used in the investigation of abnormal liver enzymes
- The use of liver biopsy is important after liver transplantation

**Contraindications**

- The uncooperative patient
- Extrahepatic biliary obstruction
- Bacterial cholangitis
- Abnormal coagulation indices
- Ascites
- Cystic lesions
- Amyloidosis

**Procedure**

The patient should lie along the edge of the bed with his right arm behind his head, which is turned to the left. A pillow should be placed firmly along the left side of the body to keep it horizontal. The abdomen is palpated and the liver is largely intrathoracic. The rib space is marked which is below the top of the liver dullness
on full expiration. It may be helpful to mark the xiphisternum and liver edge as well.

Sedation is not usually necessary, but of local anesthetic is a must. 10ml of 1% lignocaine is drawn up. The skin should be cleaned with methylated spirit and anesthetized through a 25G needle with a few drops of lignocaine in the appropriate space just above the rib. Then, using a 21G needle, the deeper tissues are anesthetized with patient’s quiet breathing and should be advanced slowly until a scratchy sensation or a gasp of pain indicates the sensitive tissues overlying the liver. The area is infiltrated with a large amount of anesthetic agent. The needle is removed and the approximate distance to the surface of the liver on the biopsy needle is measured.

The patient should be instructed on how to take several deep breaths in and out and how to hold his breath in deep expiration for as long as possible. When the physician is satisfied that the patient has understood, the skin is nicked with the point of a scalpel blade, the biopsy needle is introduced and slowly advanced with the patient breathing quietly. If the physician is not sure of the depth of the liver surface, he should continue advancing until the needle to swing with respiration; then withdrawn slightly until it stops swinging.

The breathing instructions should be repeated with the patients following the physician. As soon as the breath is held in expiration the closed needle is trusted about an inch into the liver. The inner trocar is advanced, holding the outer cutting sheath still. The physician’s right elbow is fixed against his own side (to prevent the instinctive desire to withdraw the needle), the outer cutting sheath is advanced to cut the liver in the biopsy notch, and quickly the whole needle is withdrawn from the patient. With practice this sequence should take only a second or two. It should be preferred to the one recommended by the manufacturer, as do others who were consulted, because it ensures that the specimen is taken from within the liver rather than from under the capsule.

The skin incision should be covered with a plaster and the patient should be instructed to lie on the right side for 4 hours and to remain in bed for 24 hours. Pulse rate and blood pressure should be recorded hourly, and nurses should be instructed to report at once any alteration in condition or any complaint of pain.

The biopsy material is removed from the notch and divided if specimens are needed for bacterial culture, biochemical examination, or electron microscopy in addition to histological examination. The histological specimen is placed in normal
saline on a piece of card to prevent fragmentation. The procedure should be recorded in the notes, together with the texture and naked-eye appearance of the biopsy specimen: fat, pigmentation, tumor and cirrhosis can sometimes be recognized.

Complications

• **Pain**: The most common adverse event, noted in 50% of cases. Usually it is confined to the right shoulder, probably referred pain from diaphragmatic pleura. Analgesia is required in approximately 20% of patients with acetaminophen sufficient in most cases
• **Hemorrhage**: Minor episodes are common. Self-limited oozing from the puncture site may persist for approximately 1 minute, but with loss of only 5-10 ml blood. Significant hemorrhage is less frequent
• **Bile leakage with peritonitis**: Associated with severe obstruction of the larger bile ducts. This may result from laceration of a small, distended duct or from puncture of the gallbladder. With the widespread use of noninvasive imaging, the complication rate has declined
• **Laceration of internal organs and viscera**: Right kidney, gallbladder, colon, pancreas, and others
• **Septicemia**: It may result from needling an infected bile duct or liver abscess
• **Others**: Right sided pneumothorax, arteriovenous fistula, drug toxicity

Recommendations

• Informed consent should be obtained from all patients prior to percutaneous liver biopsy in accordance with local hospital guidelines. The patient should also be able to understand and cooperate with instructions given by the person performing the liver biopsy
• Before performing a percutaneous liver biopsy, there must be a clearly defined indication for the biopsy, and the risks to the patient should not outweigh the potential benefits
• All patients who are about to undergo a percutaneous liver biopsy should have had some form of imaging of the liver within the preceding four weeks. This will allow the detection of abnormal anatomy in the area of the proposed biopsy, while at the same time detecting focal lesions which should be biopsied under image guidance
• The patient’s platelet count and prothrombin time should be checked in the week before the percutaneous liver biopsy providing that the patient's liver disease is stable
• If the platelet count is 40000-60000/mm³ then platelet transfusion may increase the count enough for the biopsy to be performed safely by the percutaneous route. However, if platelet transfusion does not increase or the platelet count is <40000/mm³ then alternative biopsy methods such as plugged, transvenous (transjugular), or laparoscopic liver biopsy can be tried
If the prothrombin time is <4 seconds prolonged, then percutaneous biopsy can be safely undertaken. If the prothrombin time is 4-6 seconds prolonged then, a transfusion of fresh frozen plasma may bring the prothrombin time into the desired range. If the prothrombin time is >6 seconds prolonged then other biopsy methods should be tried.

- Sedation should be given with caution in liver disease. Midazolam may be given as sedative for percutaneous liver biopsy.

- The type of needle used for the biopsy will depend on the experience of the operator and the type of needle they are used to. Where a larger biopsy is not required the Menghini needle should be used in preference to cutting needles as this technique seems to have a lower complication rate. Where the operator has only experience of one style of needle he should use the technique most familiar to him.

- Bacteremia associated with liver biopsy in both structurally normal and abnormal livers has been well documented. Therefore, prophylactic antibiotics should be used in the context of valvular heart disease or when there is previously documented bacteremia. The current data on the use of prophylactic antibiotics should be used.

- Usually one pass of the biopsy needle retrieves enough hepatic tissue for diagnostic purposes; however, there may be a sampling error (such as may occur in macronodular cirrhosis) which will result in an inappropriate diagnosis, then two passes may be made without significantly affecting the complication rate.

- Patients undergoing outpatient percutaneous biopsy should not have any condition that may increase the risk of the biopsy procedure.

- Post liver biopsy observation should be continued for six hours and if at the end of this period there have been no complications then the patient may be discharged. The patient should, however, have a responsible person to stay with on the first post-biopsy night and should be able to return to hospital within 30 minutes if the need arises. But it should be kept in mind that delayed hemorrhage can occur up to 15 days after percutaneous liver biopsy in patients who developed a post-biopsy coagulopathy.
Lumbar Puncture

A lumbar puncture (LP) is the insertion of a needle into the fluid within the spinal canal. It is termed a 'lumbar puncture' because the needle goes the lumbar portion of the back. Other names for a lumbar puncture include spinal tap, spinal puncture, thecal puncture, and rachiocentesis.

Indications

A lumbar puncture is most commonly done for diagnostic and therapeutic purposes. Sometimes spinal fluid removed by LP for decreasing the spinal fluid pressure in patients with uncommon conditions such as normal pressure hydrocephalus and benign intracranial hypertension. Though it may be informative in certain patients with coma or stroke, should not be done blindly as an immediate procedure until other diagnostic tests have been performed.

Diagnostic purposes

- Central nervous system infection
- Suspected subarachnoid hemorrhage
- Selected strokes, but not routinely
- Myelopathies and suspected multiple sclerosis (not suspected cord compression)
- Peripheral neuropathies

Introducing contrast media (Myelography)

Introducing therapeutic agents

- Antibiotic
- Anti-cancer drug
- Anesthetic agent

Contraindications

- Raised intracranial pressure
- Suspected cord compression
- Local sepsis
**Equipment**

An 18G LP needle is generally used. Care should be taken so that the stylet is flushed with the end, the manometer is intact and fits the needle hub. If there is a question of increased intracranial pressure, a 22G needle should be separately obtained. In addition, tincture of iodine, local anesthetic, alcohol and sponges and two pairs of sterile gloves are required.

**Procedure**

*Preparations:* The patient should be fully informed of the nature of the procedure. Although a spinal tap can be performed by one person alone, it is preferable that there be an assistant who would help hold the patient, all the manometer, and be a general help in the event of need.

*Position for performing lumbar puncture:* The patient should be placed in the left lateral position if the physician is right-handed or in the right lateral position if the physician is left-handed. Less often the procedure is performed while the patient is sitting up. In infants this is often done upright. Although an experienced operator can perform a spinal tap on a hospital bed, it is preferable that this procedure be carried out on a firm examining table. The lumbosacral region should be as close to the edge of the bed as possible. The patient is then asked to curl up to the maximum extent possible and to clasp his hands around knees and hug them as close to the chest as possible. A pillow is placed between the legs to ensure that the back is vertical. The neck should be flexed forward.

*Sterile preparation of the field:* Gloves and masks should be worn. The lumbosacral region is prepared by swabbing the L4-L5 interspace outwards in a spiral fashion until an area of approximately 20cm in diameter has been covered by using tincture of iodine. Care must be taken that the last trace of iodine should be removed with alcohol prior to the performance of the spinal tap because the introduction of iodine into the subarachnoid space can produce irritative arachnoiditis.
Performing the lumbar puncture: It is customary to use local anesthetic although many clinicians do not use local anesthesia. For spinal tap, the spaces above and below L3-L4 are equally acceptable sites, although the L5-S1 space is sometimes preferred since it is relatively the largest space. If a local anesthetic is used, an intracutaneous wheal is first raised at intended interspace. A number 20 needle on a 5cc syringe is inserted exactly as in the act of performing a lumbar puncture. Then after drawing that from the syringe to be certain that it is not reached the subarachnoid space, it is gradually withdrawn and xylocaine or procaine (2cc) is slowly injected at the interspace. The LP needle is introduced after allowing at least one minute for the lignocaine to work.

The needle is 90° to the back, with its bevel in the sagittal plane pointing slightly to the head. The needle is pushed through the resistance of superficial supraspinous ligament. The interspinous ligament is then easily negotiated. At about 4-7cm the resistance of the ligamentum flavum is felt, when an extra push will result in a popping sensation as the dura is breached. The needle should now lie in the subarachnoid space, and when the stylet is withdrawn clear colorless fluid should drip out. If the needle strikes bone it is withdrawn to just below the skin, then reinserted. Most errors are made by aiming the needle too far caudally, by being off the midline or if the needle is not precisely parallel to the ground. Upon removal of the stylet, if blood slowly drips from the needle; it should be removed and discarded and a fresh needle used.

Manometry: Once free flow of cerebrospinal fluid (CSF) is established the pressure should be measured. The manometer is connected to the end of the needle directly or via a two-way tap. An assistant holds the top end, and the resting pressure is recorded. Queekenstedt's test is performed by asking the assistant to compress the jugular vein, which would cause a quick rise of at least 40mm of H₂O, which should be recorded. Spinal block causes failure of free rise and fall and is usually accompanied by yellowish CSF with high protein content. The commonest cause of low CSF pressure is bad needle placement. But if the low pressure is genuine no attempt should be made to aspirate as the cause may be obstruction of CSF flow due to cerebellar tonsil herniation or spinal block. A slightly raised CSF pressure in a very anxious or fat patient may be ignored. The operator must be sure that the patient is totally relaxed because breath holding and tension may drive CSF pressures up by 30, 40 or even 50mm.
Collection of CSF: It is routinely collected in three or more tubes. A minimum of 10cc of fluid should be collected under all circumstances except when the pressure is elevated. If special studies such as globulin immunoelectrophoresis are to be conducted, additional amounts of CSF should be collected. It should never happen that a spinal tap has to be repeated because enough fluid was not obtained. Prior to or immediately after the spinal tap, blood should be drawn for the simultaneous determination of blood sugar.

Laboratory determinations: The following tests are routinely obtained on CSF: appearance, protein, sugar, serology, cell count, and if indicated, bacterial and fungal cultures.

- Appearance: This should be noted by the operator who performs the LP. The appearance of the CSF is not determined by holding the tube up to the light; it is best evaluated by holding the second tube against a white paper background and comparing it to another tube of the same size filled with water to an equal level. The tube is inspected for color both from side and by looking downward from above to the entire column of CSF and water.
- CSF protein is always determined on the first tube
- Cells are counted within half an hour using the third tube specimen, if the number of RBCs is elevated (greater than 20); the first tube should then be counted. In a traumatic tap there will be more RBCs in the first tube than in the third tube. If there is any question as to whether lumbar puncture was traumatic, the spinal fluid in the third tube should be spun down and the supernatant fluid checked for xanthochromia (yellow appearance). A traumatic tap may give a pink, but never a xanthochromic supernatant fluid.
- The CSF sugar must be determined within a few hours unless a preservative is added

Termination of the lumbar puncture: Closing pressures should be measured prior to withdrawal of the needle. If there is a marked discrepancy between the opening and closing pressures, the needle should not be withdrawn. A large difference between the opening and closing pressure in the majority of instance suggest the presence of a partial or complete block. If this situation is present it will be next to impossible to do a myelogram through a lumbar route. After withdrawal of the needle, the puncture point is briefly massaged with a sterile sponge and a band aid placed at the sight; the patient is instructed to lie prone on his abdomen without a pillow for at least one hour and then to remain flat in bed for an additional two to three hours. He is also advised to limit his activity for the next 24 hours. All these measures are undertaken to avoid post-puncture headache, which is an eminently preventable condition.

Recording results: All results are to be recorded by the operator immediately following the procedure including the location of the puncture, whether or not the spinal tap was traumatic, the initial pressure, the amount of fluid obtained, appearance of the fluid, and a list of tests for which it has been sent to the laboratory.
Complications and Aftercare

Headache occurs in one quarter of patients and be treated with further rest horizontally in bed, with simple analgesics but with pethidine and chlorpromazine if necessary. If the contraindications are heeded there should be no other complications.

General Observations

If the operator encounters a dry tap he should attempt to perform the spinal tap one space higher up. Three or four failed attempts should cause the operator to cease and ask another person to make another attempt with the patient repositioned and re-draped as if he were having his first tap. If these attempts fail, it is recommended that the operator consult with the anesthesiology service or with radiology to perform this procedure.
Introduction of Nasogastric (NG) tube is probably one of the most commonly done procedures in hospital practice, there are two main indications for passing a Nasogastric tube. One is to aspirate stomach contents either as a diagnostic test for example, using pentagastrin or as a therapeutic measure for example, in the ‘acute abdomen’. The other is to maintain nutrition of the patient, either when he should not swallow for example, after pharyngeal surgery or when the patient cannot swallow for example, in postcricoid carcinoma, before treatment.

Equipment

- Dressing pack
- Tube of approximate size (16 French gauge)
- 50/60ml syringe with appropriate tips
- Leucoplast/micropore
- Drainage bag if required
- Glass of water
- Lubricant (water soluble jelly), lignocaine jel 2% antiseptic may be required for some patients
- Gloves
- Litmus paper
- Stethoscope
- Tongue depressor

Procedure

- Verbal and written instruction about the procedure should be given
- Procedure should be explained to the patient and should be asked to swallow several times during insertion of the tube
- Patient should be sitting well up in bed with head tilted forward (if not contraindicated)
- Hands should be washed properly, and gloves should be used
- Measurement of the tube a) distance from the lobe of the ear to tip of the nose b) from the lobe of the ear to the xiphisternum, and total length on the tube marking should be noted
• Tube should be lubricrated and it is better to use freezing tube that may assist insertion
• Tube then be gently inserted along the floor of the nose in backward downward direction
• Patient should be encouraged to facilitate the tube passage by swallowing and if permitted, sips of water can be given to assist the procedure
• Tube should be inserted to the predetermined distance
• Aspirate can be tested with litmus paper to establish acidity of stomach contents and after inserting a bubble of air, it can be heard over stomach with a stethoscope

Problems

Difficulties in passing the tube may occur at any point along the route:

Choking usually indicates that the tube entered the trachea and should be withdrawn immediately

Nose- the tube should be passed along the floor of the nose and not towards the bridge. If one nostril is narrowed by a deviation of the nasal septum, it is better to use the other side, although there is often a ‘tunnel’ along the floor of the nose which can be used. A smaller tube can be selected in the event of persistent difficulty and in such cases a topical vasoconstrictor (for example, ephedrine 0.5% drops) can be used.

Oropharynx- reflex gagging by the patient may direct the tube into the mouth. There are various ways of dealing with this problem:
• Repeated attempts of insertion can be tired
• Cold stiffen tube should be inserted to overcome this problem because it is less likely to coil
• The passage of the tube should be observed through the mouth with a depressor on the tongue. A pair of long forceps can be used to guide the tube down
• A benzocaine lozenge 10mg should be sucked for 10 minutes for a failed measure. A Mackintosh laryngoscope can be used to visualize the oropharynx after laying the patient flat, the head of the bed should be removed. The tube should be directed past the base of the tongue as an assistant introduces it through the nose. There is no need to visualize the larynx, for as long as the tube passes posterior pharyngeal wall it should enter the esophagus

Esophagus- a stricture or pharyngeal pouch may prevent the tube from passing, and this is probably the only indication for using a general anesthetic. Obstruction of the tube may be due to blockage by its contents or to the tube twisting on itself. A blockage should be cleared by flushing (citrate solution seems to help), and a twisted tube is corrected by partially withdrawing it until it functions again, then relocating it. Perforation of the esophagus is extremely unlikely in the absence of esophageal disease.
Pleural Aspiration and Biopsy

Pleural fluid aspiration is a procedure to aspirate pleural fluid for diagnostic and therapeutic purposes. A pleural biopsy is the removal of pleural tissue for examination. It is an invasive procedure, and is not recommended for patients with severe bleeding disorders.

Pleural Aspiration

Indications

In diagnosis
- To confirm the presence of effusion
- To diagnose empyema and hemothorax
- To distinguish transudate from exudate
- To identify malignancy and infection

In treatment
- To relieve dyspnea (cardiorespiratory embarrassment, acute pulmonary edema)
- To remove blood or pus
- To instill antibiotics for empyema
- Persistent pleural effusion inspite of antitubercular therapy
- Large pleural effusion or bilateral pleural effusion

Aspiration Procedure

It is important that the patient is as comfortable and relaxed as possible. The best site for pleural aspiration is decided by locating the fluid by percussion and from postero-anterior and lateral radiographs. A common error is to insert the needle too low down or too far forward. When the fluid is not loculated the easiest site for puncture is on the posterior chest wall medial to the angle of scapula. The patient should be positioned leaning slightly forwards with arms flexed comfortably before him and resting on a pillow.

The operator should scrub up and be gloved and gowned as for any surgical procedure. The patient's skin is prepared with a suitable antiseptic and sterile towel. The skin overlying an intercostal space at the chosen level is infiltrated with 1% or 2% lignocaine using a 25G needle. This is then changed for a 21G needle to infiltrate the chest wall down to the pleura. While penetrating pleura,
fluid should appear in the syringe as the plunger is withdrawn. To avoid damage of the intercostal neurovascular bundle, the inferior border of the upper rib is avoided. Care must be taken to ensure that air does not enter the pleural space at any stage of the procedure.

When the tap is for diagnosis only, 20-50ml fluid is aspirated into a sterile syringe and put into sterile plastic or glass containers. After labeling these are sent for microscopy for blood cells, cytology and organisms; for bacterial culture (including acid-fast bacilli); estimation of fat (if chylous), protein and glucose content (low in rheumatoid disease).

To remove a large quantity of fluid, a needle with attached three-way tap or a ready-prepared pack consisting of needle, three-way tap, connecting plastic tube, syringe and collecting bag are used. Aspirating large volumes of fluid in this manner may be protracted and uncomfortable for the patient, and it is sometimes easier to insert a catheter such as the 12 or 14 gauge E-Z catheter intravenous placement unit and, after withdrawing the central needle and stylet, to connect a three-way tap and syringe to the Luer fitting on the end. When the needle or catheter is removed a small adhesive dressing is adequate for the puncture site.

Special Circumstances: Difficulties may arise in patients with empyema and hemothorax when the fluid is thick or loculated. Aspiration may be possible only with a large-bore needle, an exploratory aspiration at several different sites may be necessary. The finding of pus is an indication for instilling antibiotics while the needle is in the empyema space; it may be difficult to locate the space at a later attempt. If the empyema is a complication of bacterial pneumonia then laboratory information on the organism and its antibiotic sensitivities may already be available then ampicillin (500-1000mg) in 10-20ml of water for injection or a cephalosporin should be instilled. Foul smelling pus usually indicates an anerobic infection, for which metronidazole is appropriate. Repeated aspiration and intrapleural instillation of antibiotic should be continued until pus is no longer obtainable. If there is then still evidence of continuing infection, insertion of an intercostal drainage tube is indicated, followed, if necessary, by rib resection with evacuation of empyema cavity. The skin is sealed with tincture benzoin seal.
Complications

It is usually recommended that not more than 1-1.5 liter is aspirated at one time. If fluid is removed too quickly or too great in quantity, edema may develop in the re-expanded lung tissue. A high negative intrapleural pressure may develop as fluid is aspirated resulting in difficulty in free expansion of lung. This will be felt by the operator as an increased pull on the plunger and by the patient as chest tightness accompanied by coughing. Both of these complications can be relieved by letting air into the pleural space to lower the negative pressure, but this delays re-expansion of the lung and may permit loculation of the fluid. In the absence of a clotting defect, pleural aspiration rarely leads to serious hemoptysis or hemothorax. Pneumothorax can result if the needle penetrates the visceral pleura or if air is inadvertently allowed to enter via the needle. If the pneumothorax is large an intercostal drain with underwater seal may be required. If the aspiration needle tears the visceral pleura and a superficial vein, air may be sucked into the pulmonary veins from the needle itself or from the adjacent lung. The air may enter any systemic artery, most often the cerebral vessels, and produce transient neurological symptoms and signs. The customary emergency treatment is to tilt the patient head down and with his right side uppermost to reduce the chance of air entering these arteries. Many deaths previously certified as 'pleural shock' were probably due to air embolus, but vagal inhibition can also occur. Empyema after a non-sterile aspirating technique is rare, but nevertheless infection may be introduced and may convert a sterile pleural effusion into a difficult empyema. Possible complications in cases of mesothelioma should be borne in mind.

Pleural Biopsy

Indications

Pleural biopsy is usually done when examination of aspirated pleural fluid suggests infection, signs of cancer or tuberculosis. Pleural biopsies are 85-90% accurate in diagnosing these diseases. It is also done to differentiate benign and malignant disease, to diagnose viral, fungal, or parasitic diseases, and to identify a condition called collagen vascular disease of the pleura. It is also done when a chest X-ray indicates a pleural-based tumor, reaction, or thickening of the lining. Needle biopsy of the pleura should be performed at the time of a diagnostic pleural aspiration if the cause of the effusion is not then
apparent. If mesothelioma is strongly suspected, however, it is better to avoid a needle biopsy because of the risk of seeding mesothelioma cells in the needle track. Fluid cytology without biopsy is sometimes sufficient for diagnosing this condition.

**Equipment**

An Abrams needle, most widely used in Britain, consists of outer and inner tubes, the outer acting as a trocar. Behind the tip of the outer tube is an opening into which a fold or pleura is to be impacted. This opening is closed completely when the cutting edge of the inner tube is advanced by twisting its hexagonal grip clockwise. This rotation moves a pin in the hilt of the inner tube forwards along a spiral slot in the hilt of the outer tube. The biopsy specimen is cut by the advancing edge of the inner tube and is retained within the instrument. It can then be retrieved by using the accompanying blunt obturator. Another type needle named blunt-type Cope is also available.

**Procedure**

The procedure most often performed for pleural biopsy is called percutaneous needle biopsy—passage through the skin by needle puncture. The procedure takes 30-45 minutes, although the biopsy needle itself remains in the pleura for less than one minute. Pleural biopsy can also be performed in several other ways like by thoracoscopy (insertion of a visual device into the pleural space for inspection) or by open pleural biopsy under general anesthesia.

The patient is positioned and prepared as for a pleural tap. The actual procedure begins with the patient in a sitting position, shoulders and arms elevated and supported. The skin overlying the biopsy site is anesthetized and a small incision (3-5mm) is made to allow insertion of the biopsy needle. This needle is inserted with a cannula (a plastic or metal tube) until fluid is removed. Then the inner needle is removed and a trocar (an instrument for withdrawing fluid from a cavity) is inserted to obtain the actual biopsy specimen. As many as three separate specimens are taken from different sites during the procedure. These specimens are then placed into a fixative solution and sent to the laboratory for histopathology. If tubercular pleurisy is suspected, specimen should be placed in a dry, sterile container for bacteriological culture.

**Complications**

Potential complications of this procedure include bleeding or injury to the lung or pneumothorax. Other complications include air embolus, pulmonary edema, vagal inhibition or seeding of mesothelioma cells. Because of these possibilities, the patient is to report any shortness of breath, and to note any signs of bleeding, decreased blood pressure, or increased pulse rate.
Proctoscopy and Sigmoidoscopy

Proctoscopy and sigmoidoscopy are the internal examination of the anal canal, rectum, distal sigmoid colon and large bowel using different viewing instruments by which lesions can be diagnosed and biopsy can be carried out. These are used for diagnosis, treatment and follow-up of some diseases. Rectal swabs are sent for bacteriological studies or specimens of feces for identification of parasites. Internal hemorrhoids could be treated by injection through a proctoscope, and excision or diathermy of small localized lesions are carried out through a sigmoidoscope. Follow-up examinations are useful to evaluate whether inflammatory conditions are subsiding, persisting, or worsening. The response to medical treatment should be monitored-for example, improvement in non-specific proctitis after a course of steroid enemas.

Indications

Although the precise indications are still being debated, common uses include:
- Screening of healthy, asymptomatic adults for colorectal cancer
- Evaluation of the patients with suspected lower gastrointestinal pathology with a barium enema study
- Management of lower gastrointestinal bleeding
- Evaluation of the patient with suspected diseases of the colon, such as inflammatory bowel disease, infectious colitis, sigmoid diverticulitis and others
- Diagnosis and evaluation of hemorrhoid and anal fissure
- Evaluation of the causes of persistent diarrhea
- Obtaining a biopsy specimen from lower gastro-intestinal tract

More controversial indications include:
- Temporary decompression of sigmoid volvulus (recurrence of the volvulus is common without propt surgery) and
- Cancer surveillance in patients who have undergone surgical resection of a sigmoid colon neoplasia (to rule out recurrence at the anastomosis)

Contraindications

Few absolute contraindications exist for the procedures. However, the procedure should best be avoided in the following high-risk situations:
- Severe diverticulitis
• Acute peritonitis
• Toxic megacolon
• Severe underlying cardiac or pulmonary disease
• Uncorrectable coagulopathy
• Acute intestinal perforation
• Massive gastrointestinal bleeding
• In addition, flexible sigmoidoscopy should not be performed in situations where colonoscopy is indicated

Preparation Before Proctoscopy and Sigmoidoscopy

Details of the procedure should be discussed with the patient, including goals, technique and risks. Informed consent should be obtained. Preparations for the procedure may be varied.

• The patient should be advised to follow a liquid diet (eating only juice, water, plain coffee or plain tea) for 1-2 days before the test
• Patient should avoid eating for up to 12 hours before the test
• Patient should be requested to discontinue taking some medications (such as aspirin or warfarin) for a period of 10-14 day before the test
• To prevent infection the patient should start taking antibiotics before the test, if he has certain type of heart murmur, or an artificial heart valve, or an artificial implant
• Patient may need to have an enema the night before the test and/or another enema an hour before the examination
• Some doctors may require no special preparation at all, especially if the patient have watery or bloody diarrhea
• In the majority of cases, premedications such as sedatives, narcotics, or anesthetics are not necessary. Short-acting benzodiazepine may occasionally benefit the patient
• The patient should not have sigmoidoscopy or proctoscopy within a week of having a barium enema test. The presence of barium in the colon and rectum can make it difficult to see the inside of the colon and rectum

Digital Rectal Examination

It is actually done before any of these tests. A digital (finger) rectal examination checks for abnormalities of organs or other structures in the pelvis and lower abdomen. During digital rectal examination a lubricated gloved index finger of one hand is inserted into the rectum and the other hand may be used to press the lower abdomen or pelvic area. The examination is commonly done to check the prostate gland in men and the uterus and ovaries in women. The other organs such as the bladder can also be felt during the examination. A digital rectal examination is routinely done for men as part of complete physical examination
and for women as part of a regular gynecological examination (usually done at the
time of a 'Pap test'). The examination may also be done to help identify the cause
of symptoms such as rectal bleeding or blood in the stool, abdominal or pelvic
pain, a change in bowel habits, or urinary problems in men.

**Proctoscopy**

All general practitioners remain familiar with diagnostic proctoscopy. It can be done
without difficulty or discomfort in the doctor's surgery or out-clinic without general anesthesia.

**Equipment**: the simplest diagnostic proctoscope is a cylindrical tube with a handle at
one end and an obturator for insertion into the anal canal. It should be 2cm or more in
diameter for adequate visual inspection. There are many other types of proctoscope which
can also be used therapeutically. They have distal angels or slits.

**Position of the patient**: It is important to ensure that the patient must be lying in the correct position,
comfortable and relaxed. The left lateral position is usually advocated, with the
bottom pushed backwards and both hips flexed the right leg above the left to tilt
the anal opening upwards.

**Technique**: It is essential to insert the lubricated forefinger through the anal canal
and examine the lower part of the rectum before attempting to pass a proctoscope. Anal stenosis or severe pain on digital examination is a
contraindication to the passage to either instrument. The caliber of the anal canal
should be judged at the preliminary examination in the index finger, and too large
an instrument should not be used. An adequate source of light must be available
before the proctoscope in inserted- this may be a bright torch or Anglepoise lamp,
or a side bulb built into the proctoscope. A straight pair of artery forceps should be
at hand holding a pledget of damp cotton wool to clean the mucosal surface to
remove fecal matter through the proctoscope. The proctoscope should first be
warmed under the hot tap, dried, and well lubricated. It is passed by pushing the
head of the trocar firmly but gently through the anal canal in the direction of the
umbilicus, and when through the anus it is turned in the direction of the patient's
head and inserted to the hilt. The trocar must be held fully engaged in the proctoscope during the insertion to avoid nipping the anal mucosa. Close inspection should be made as the instrument is withdrawn, firstly of the lower rectal mucosa and then of the anal canal and any hemorrhoids bulging into the lumen of the proctoscope or the linear raw area of a fissure must be noted.

**Injection of internal hemorrhoids**- an injecting proctoscope is used for this procedure and rotated so as to allow the pile to bulge into the side aperture. Through a special hemorrhoid needle 3-5ml of 5% phenol in oil is injected submucously into the base of the pile; the injection must not be intravascular.

**Normal findings from above downwards are** - i) typical colorectal mucosa-pink in color, with numerous folds ii) Transitional zone is approximately 1cm. Color changes from pink to purple with 8-14 vertical columns of Morgagni iii) Dentate line is the most important structure, which demarcates ectoderm from endoderm, acute sensation from absent sensation and stratified epithelium from mucosa. It has a serrated appearance with crypts and papillae and iv) the region of modified skin or anoderm is also about 1cm in width.

**Sigmoidoscopy**

It is the visual examination of the inside of the rectum, distal sigmoid colon and large bowel using a device known as sigmoidoscope. The colon is 5 feet (1.52 meter) to 6 feet (1.83 meter) long. During sigmoidoscopy only the last 1-2 feet (0.61 meter) of the colon is examined.

**Equipment:** the sigmoidoscope is a rigid or flexible lighted tube. The rigid sigmoidoscope is about 10 inches (25.4 cm) to 12 inches (30.48 cm) long and 1 inch (2.54 cm) wide. It allows the doctor to look into the rectum and a portion of the lower large intestine (colon). The flexible sigmoidoscope is about 0.5 inch (1.27 cm) wide and 2 feet (60.96 cm) long. A flexible sigmoidoscope allows a more complete view of the lower colon and usually makes the examination more comfortable than a rigid sigmoidoscope. The flexible sigmoidoscope can be directed and moved around the bends in the lower colon and rectum. The image in the bowel is transmitted through the sigmoidoscope either to the eyepiece or a video screen. An open channel in the sigmoidoscope allows other instruments to be passed through it to take tissue samples (biopsies) or to remove polyps. The traditional sigmoidoscope has a proximal bulb light, but the newer fiberoptic model with a circular distal light should be preferred. The insufflating bulb is an important part of the instrument, as the upper half of the rectum and lower sigmoid colon can be seen clearly only when air is blown in to distend the lumen.

**Special Instructions:** Due to the risk of bacteremia during sigmoidoscopy, antibiotics may be useful for prevention of bacterial endocarditis in patients with high-risk heart disease. Patients who are at risk for endocarditis include patients
with prosthetic heart valves, rheumatic valvular disease, previous history of endocarditis and others. Such patients may benefit from antibiotic prophylaxis, although the risk of endocarditis is low.

**Procedure:** Complete visualization of the rectum and lower sigmoid colon usually needs a general anesthetic. The lithotomy position is most commonly used, with a head down tilt to the table. The lower abdomen should first be palpated for the presence of a mass; digital palpation of the rectum then follows, and finally bimanual palpation with the right index finger in the rectum and the left hand on the lower abdomen. The prone jack-knife position has its advocates but precludes abdominal palpation.

Sigmoidoscopy can be done without a general anesthetic in the left lateral position, and a transparent disposable plastic sigmoidoscope is probably the best and most comfortable instrument for this, although passing the rectosigmoid bend may be so painful as to be impossible.

As soon as the end of the sigmoidoscope has penetrated the anal canal the trocar is removed, the inspecting end closed, and examination of the rectal mucosa carried out carefully from below upwards. When the upper rectum is reached the end of the sigmoidoscope should be moved to the patient's left, backwards, and then forwards to round the rectosigmoid bend into the lower sigmoid colon. It is vital to get a clear view of this area, as it cannot be felt digitally per rectum or by lower abdominal palpation. The operator must be prepared patiently to clear the rectum of feces by digital removal, scooping them out in the sigmoidoscope or using pledgets on long-handled forceps. A sucker must always be available but used gently and its end guarded with a rubber tube. The instrument must never be forced upwards; the blanching of the mucosa is a danger sign.

The mucous membrane should be inspected for color, texture and mobility. Erosions, ulcers, adenomas, polyps, and the raised edge of a carcinoma are looked for and biopsy specimens are taken. The barrel of the sigmoidoscope is calibrated in centimeters, and the distance of any lesion from the anal verge must be noted. Rectal biopsy specimens should normally be taken posteriorly 6-8cm from the anal verge; high anterior biopsies run the risk of perforation. The presence of blood and pus in the lumen should be noted and also the contour, consistency, and shape of the fecal masses- for example, diverticular disease can be diagnosed by finding a contracted corrugated fecal cast. Proctoscopy should be done after sigmoidoscopy, as anal lesions might be missed through the sigmoidoscope.

**Limitations:** This examination can be embarrassing and uncomfortable but educating the patient what to expect can help to eliminate it. There will be pressure when the instrument or fingers are introduced into the rectum. There will be a feeling of the need to defecate during the procedure. There might be some
bloating or cramping from distention of the bowel by air or stretching by the sigmoidoscope. The removal of tissue samples (biopsy) is painless because the lining of the colon does not have any pain sensation. If a suction machine that removes stool, mucus or blood is used during sigmoidoscopy, it can be noisy. Lying in a head-down position can cause the patient to feel a sense of fullness and pressure in head and face. Dizziness may occur if the patient tries to stand up too quickly. The patient should lie down again or sit with head between the knees to avoid dizziness.

Aftercare: In general, patients may resume their prior level of activity after sigmoidoscopy. Since sedatives are not administered in most cases, patients may go home after the procedure.

Specimen: All biopsy specimens and cytologic brushings are sent to the pathology laboratory promptly. Any tissue or stool samples for microbiological culture should be sent in sterile containers without fixative.

Findings: Important aspects of the examination findings often include:
- Indications for procedure
- Depth of visualization (e.g., 35cm, 60cm)
- Appearance of the mucosa
- Abnormalities such as polyps (size, appearance), pseudopolyps, fissures, neoplasms, ulcers, friable regions, blood, pus, diverticula, and others.
- Therapeutic procedure performed
- Sites of biopsies
- Sites of cultures
- Complications

Benefits: the benefits of sigmoidoscopy can include the following:
  i) It is often possible to determine the specific cause of symptoms
  ii) Conditions such as colitis and diverticulosis can be monitored to determine effectiveness of treatment
  iii) Polyps and tumors can be discovered at an early stage

Conclusion

Colon cancer is one of the most common cancers in the elderly. It is highly curable if it is diagnosed early. This cancer usually begins in the colon as a polyp that remains benign for many years. Therefore, it is generally advisable to have a sigmoidoscopy after the age of 40 or 50 years. The tendency to develop colon cancer and polyps can be inherited. So, if parents, brothers, or sisters have had colon polyps or colon cancer, it is even more important to have this examination. Although regular sigmoidoscopy can lower the risk of death from colon cancer as much as 40%, this examination is limited to screening for cancers in the last one third of the bowel. To check for cancers in the bowel, a colonoscopy is necessary.
Prostate Biopsy

Prostate biopsy is a surgical procedure that involves removing a small piece of prostate tissue for microscopic examination. Examination of prostatic tissue obtained by biopsy has been used to judge the response of a tumor to either hormonal or cytotoxic manipulation. Culture of the prostatic tissue may be useful in difficult cases of prostatitis.

Indications

This test is usually done to determine whether the patient has prostate cancer. Occasionally, it may also be used to diagnose benign prostatic hyperplasia (BPH). Prostate biopsy is recommended when a digital rectal examination (a routine screening test for prostate diseases) reveals a lump or some other abnormalities in the prostate. In addition, if blood tests reveal that the levels of certain markers, such as prostate-specific antigen (PSA), are above normal, the doctor may order a biopsy.

Procedure

Prostate biopsies can be performed in three different ways. They can be performed by inserting a needle through the perineum (the area between the base of the penis and the rectum), by inserting a needle through the wall of the rectum or by cystoscopy. Now-a-days an updated form of needle biopsy is done using the transrectal ultrasound.

Needle biopsy may be performed as an out-patient procedure. Since penetration of the prostate by the needle causes some discomfort therefore general anesthesia, local block, or intramuscular pethidine and diazepam are necessary. The patient is placed in either on lithotomy or lateral position with any degree to
Trendelenburg that thought to be necessary. Very few patients are unsuitable because of ill health or inaccessibility of the prostate. The biopsy may be performed by using either a perineal or transrectal route: these methods are described separately.

Sampling via the perineal route is a semi-sterile technique, requires the perineum to be shaved and the skin cleansed in the usual manner. A tiny incision in the midline, 1.0-1.5cm anterior to the anal verge is made with a size 15 blade. Then the biopsy needle is inserted through this incision into the prostate and its course to the area to be sampled estimated by placing a finger in the rectum.

Transrectal biopsy, a non-sterile technique, entails passing the needle with the examining finger into the rectum. To minimize the needle should be protected by the pulp of the finger during insertion. The surgeon then palpates the area of prostate in doubt and the needle is introduced directly through the rectal mucosa. In both the above methods tissue is obtained by advancing the trocar and then closing the cannula on to the trocar. With a little practice the trocar may be held firmly by the remaining fingers of the left hand so that removal of the finger from the rectum is not necessary. The tissue is then placed in preservative for histological examination or transport medium for bacteriological examination. Several samples may be obtained at the same time, although this slightly increases the risk of complications.

Before scheduling the biopsy, the doctor should be made aware of all the medications that the patient is taking, if the patient is allergic to any medication, and if he has any bleeding problems. The patient may be given an antibiotic shortly before the test to reduce the risk of any infection afterwards. If the biopsy is done through the perineum, there are no special preparations. If it is being done through the rectum, the patient is asked to take an enema and is instructed on how to do it.

Cystoscopy is generally performed in an operating room or in physician’s office. An hour before the procedure, the patient is given a sedative to help him relax. An intravenous line will be placed in a vein in the arm to give medications and fluids if necessary. The patient is asked to lie on a special table with his knees apart and stirrups are used to support his feet and thighs. The genital area is cleansed with an antiseptic solution. If general anesthesia is being used, the patient is given the medication intravenously or inhaled gases or both. If a local anesthetic is being used, the anesthetic solution is gently instilled into the urethra.

After the area is numb, a cystoscope (a thin-lighted tube with telescope lenses) is inserted into the urethra and slowly pushed into the prostate. Tiny forceps or scissors are inserted through the cystoscope to collect small pieces of tissue that are used for biopsy. The cystoscope is then withdrawn. The entire procedure may take 30-45 minutes. Sometimes a catheter is left in the urinary bladder to help the
urine drain out, until the swelling in the urethra has subsided. If a cystoscopy is being performed, the patient is asked to sign a consent form. The patient is also asked to take antibiotics before and for several days after the test to prevent infection due to insertion of the instruments. If a general anesthetic is going to be used, food and liquids will be restricted for at least eight hours before the test.

Transrectal Ultrasound and Prostate Needle Biopsy: Transrectal ultrasound (TRUS) is an out-patient procedure that uses sound waves to create a video image of the prostate gland. A small, lubricated probe placed into the rectum releases sound waves, which create echoes as they enter the prostate. Prostate tumors often create echoes that are different from normal prostate tissue. The echoes that bounce back are sent to a computer that translates the pattern of echoes into a picture of the prostate. While the probe may be temporarily uncomfortable, TRUS is essentially a painless procedure. Although TRUS alone cannot detect every tumor, it has been shown to detect many tumors that cannot be felt by a digital rectal examination. In addition, TRUS is used to estimate the weight of the prostate gland, helping doctors get a better idea of PSA density, which helps distinguish benign prostatic hyperplasia from prostate cancer. Finally, it plays a vital role in guiding the needle to just the right part of the prostate gland. Prior to TRUS, the patient may be instructed to have an enema to remove feces and gas from the rectum, which might impede the progress of the rectal probe. The patient traditionally lies on his left side, which is considered a more relaxing position as well as allowing for easier insertion of the rectal probe. After the probe is inserted into the rectum, the tester adjusts the console on the ultrasound machine to a baseline for the echoes of normal prostate tissue, which will serve as the standard by which other tissue will be classified. Imaging is usually begun at the base of the bladder, as the probe is rotated to provide a full picture of the prostate.

If prostate cancer is suspected, a biopsy is recommended. A prostate needle biopsy is a surgical procedure in which a small sample of tissue is removed from the prostate gland and examined under the microscope by a specialized doctor. The procedure takes about 15 minutes and is usually performed in the urologist’s office in conjunction with Transrectal ultrasound that uses sound waves to create a video image of the prostate gland. No anesthetic is required. With the help of TRUS, a doctor guides a biopsy gun- a hand-held device with a spring-loaded, slender needle through the wall of the rectum into the area of the prostate gland that appears abnormal.
The rectal wall is thin, so it is possible to place the needle more accurately and with less injury to other tissues. A sliding sheath opens once the needle enters the prostate, closes onto a sample of tissue, and the needle is withdrawn.

A sextant biopsy is most commonly done to get a representative sample of the prostate gland and determine the extent of any cancer. The tissue samples must be examined by a histopathologist, who then generates report of the findings.

**Precautions**

Oral antibiotics could be started the night before the biopsy and for 24-48 hours afterwards, to protect against possible infection. To limit the risks of bleeding patients are advised to stop taking aspirin 7-10 days before the biopsy, and to stop taking anti-inflammatory medications.

**Complications**

It is normal to expect some minor bleeding after needle biopsy, because the needle has entered areas that contain small vein. Blood in the urine, semen, and with bowel movements may occur intermittently for a few days and even for a few weeks. The two primary risks of needle biopsy are severe bleeding and infection of the prostate gland or urinary tract. These risks are very rare, occurring in less than 1 percent of patients. In rare cases tumor implantation may also occur.
Removal of Drains and Sutures

Drains and sutures play an important and at times vital part in the recovery of the patient although they are inserted at the end of an operation, when the important parts of the procedure seem to be over. It is wise to have a rule that the surgeon who inserted a drain or sutures is the person who decides on removal.

Reasons for Insertion of Drains

Drains provide a mechanical means of removing material that would otherwise be harmful to the patient, and this may be pus, air, blood, urine, or alimentary secretions. The different reasons for inserting drains will dictate the way in which they are managed. In many operations-for instance, inguinal hernia repair- there is no need to insert any drain. After total mastectomy air is trapped under the skin flaps and even with good hemostasis, blood and serum will drain from the chest wall. These prevent the skin flaps from adhering if drainage is not provided. A hematoma can be dangerous after thyroidectomy and hematoma delays healing after excision of the rectum. However, in precise the three main reasons for inserting drains are-

- To remove air and blood that will delay healing and recovery
- To drain abscesses and
- To provide a safe and convenient route for secretions to leave the body

Drainage of Abscesses and Secretions

Drains inserted to remove secretions are usually placed in the abdomen. After operations such as cholecystectomy and ureterolithotomy the surgeon hopes that there will be no drainage of bile or urine but cannot be certain of this. Accumulation of bile or urine in the body can cause serious complications, so a soft latex-rubber drainage tube is placed beside the operation site and attached to a sterile transparent plastic bag. If no appreciable drainage is seen in the bag after 48-72 hours these drains may safely be removed.

When urine is being deliberately diverted through a tube- for example, after
suprapubic cystostomy or nephrostomy - the timing of removal depends on the reason for drainage and is decided solely by the surgeon. Sometimes drains have to remain in position for a long time. After drainage of a subphrenic abscess or an empyema a large cavity is left, which will contract and heal only slowly: the tube must not be removed until the cavity is obliterated. This process is followed up by injecting sodium diatrizoate along the drain every 7-10 days and exposing X-ray plates.

After gastrectomy or intestinal resection and anastomosis there is a period of 5 to 7 days during which the anastomosis is healing but still depends on the integrity of the sutures. So it is essential for the drainage tube beside the anastomosis to remain until this period is over and leakage from the suture line is unlikely. There is always a tendency for fibrinous adhesions to occlude an intraperitoneal drain, so it is wise to shorten such drains after 4-5 days: this often disturbs adhesions and allows a sealed-off collection of fluid to drain. It is essential to fix the shortened drain securely so that it cannot be accidentally pulled out.

Removal of Air and Blood

Usually after thyroidectomy the drains are removed after 24-48 hours when they cease to be useful. After an extensive operation like mastectomy it is important to measure the volume of fluid drained each day, and it is often 5-6 days before this has dwindled sufficiently to permit removal. These drains are secured by a suture, and on removal this stitch is cut and the drain swiftly withdrawn so that air does not re-enter the wound through the side holes in the tubing.

Intrapleural drains require special care because disconnection will result in pneumothorax. All these drains are attached to underwater seal bottles, and if suction is not being applied to the open end of the bottle, there should be a respiratory swing in the level of fluid in the tubing.

Management of these drains is always under the control of the surgeon. When the drain is ready for removal the suture securing it to the skin is cut, a pad made of a thick square of tulle gras surmounted by several layers of gauze is pressed firmly over wound and drain, and the drain is swiftly withdrawn; the pad is strapped firmly over the drain hole. In this way entry of air into the pleura during removal of intrapleural drain could be avoided.
**Insertion of T-tube**

After exploration of the common bile duct a T-tube of latex rubber is usually inserted to permit direct drainage of the infected and distended duct. The external end of the tube is placed into a sterile plastic bag (sealed drainage) hanging beside the bed, and the volume of bile drained is recorded every 24 hours. Occasionally this volume is high and constitutes an important source of water and electrolyte loss. After 8-10 days' drainage cholangiography is usually performed to ensure that there is free drainage into the duodenum and no sign of a residual stone. The T-tube is withdrawn by steady traction 24 hours later.

**Special Attention and Considerations Regarding Drains**

Efficient drainage is important for most of the circumstances, but it is equally important that the drain track should provide no entry for bacteria, so a secured system of closed drainage is essential. Most surgeons use a ‘Redivac’ type of drain, in which a fine tube with multiple side holes is inserted through a stab wound and attached through closed tubing to a suction bottle: this has proved effective and bacteriologically safe.

A soft tube is of great advantage to use instead of corrugated rubber as the fluid passing along it can be collected, measured, and analysed, and the secretion does not contaminate the abdominal wall. This can be extremely important if, for instance, a pancreatic or small-intestinal fistulae is formed. One of the serious aspects of duodenal and pancreatic fistulae is that the enzymes are proteolytic and can cause serious digestion of wounds. With the development of intravenous feeding it is possible to wait while fistulae gradually contract and heal, during which time it is sometimes helpful to use a sump drain. This allows secretions to be aspirated near to their point of origin, which protects the tissues from digestion and keeps the patient comfortable. Modern disposable drainage bags easily permit collection and measurement and keep the drainage system closed, preventing reflux of air and bacteria along the tubing.

**Removal of Skin Sutures**

Sutures or stitches are the most commonly used method to fix a cut or wound. Other methods are skin adhesives or glue, Steri-Strip or butterfly bandages, or even leaving skin openings alone in some cases. Suture material may be absorbable or nonabsorbable. Suture marks- the imprinted scar of the pressure
of suture material on the skin surface—are determined by the time for which a suture is left in place, its tension, and its position. So, the patient should be advised to return for a wound check for any unusual conditions such as, unexpected swelling, erythema or drainage. The stitches are left in place for varying times depending on their location. The usual guidelines for when particular sutures will be removed are as follows:

- Face 3-4 days
- Neck 5 days
- Scalp 6 days
- Chest or abdomen 7 days
- Arms and back of hands 7 days
- Legs and top of feet 10 days
- Back 10 days
- Palms and soles 14 days

**Procedure**

For removal of sutures the patient should lie comfortable. There should be a good source of light; a sharp fine-pointed pair of scissors and fine, non-toothed dissecting forceps. The suture should always be divided close to the skin below the knot. Then it is gently pulled out towards the side on which it was divided, using the points of the scissors to give counter pressure on the wound.

**Aftercare**

After removal of sutures-

- Care should be taken to protect the wound from injury during the following month
- Sports should be avoided that could re-injure the wound. If a sport is essential, tape can be applied before playing
- Scab should be allowed to fall off naturally. One should not try to remove it

**Special Attention**

Stitches should be removed when the purpose is achieved. If there is any delay in removal, it may leave unnecessary skin marks and occasionally scarring. It also makes suture removal more difficult. If there is any complications like infection, fever, sutures come out early, then medical attention should be sought immediately.
Ear Syringing

Ear syringing aims to remove wax (cerumen) from the ear canal and is an essential skill for anyone who treats ear problems. Wax is the secretion of the auditory meatus. Its consistency may be affected by atmospheric pollution. Normally it is expelled by ordinary chewing movements, but in some patients this does not happen. The wax then accumulates and may eventually block the external auditory meatus.

Consequences of Wax Formation and Indications of Ear Syringing

Symptomatic
- Hearing loss: (a.) acute onset: Water in the ear may cause sudden swelling of the wax (for example, when swimming under water), which brings the patient rapidly to the doctor. (b.) Gradual onset: the hearing loss may go unnoticed by the patient for a long time
- Earache: when the wax is pressing on the drum
- Cough: when the wax is pressing on the auricular branch of the vagus nerve
- Giddiness: Sometimes present when there is an obstruction by wax in one meatus only

Asymptomatic
Wax is frequently seen on routine examination. If the examination is for an insurance or pre-employment medical check-up it may be necessary to remove the wax to ascertain whether a) the hearing is normal or b) the drum is perforated. Plugs of wax that do not block the meatus (and hence cannot affect the hearing) and still enable the drum to be seen may safely be left. Sometimes a thin film of wax on the drum (not painful) may give the impression that there is a perforation. It should be noted that, the ordinary process of syringing when the middle ear is not inflamed often causes a temporary redness of the drum, which may confuse the diagnosis.

Contraindications of Ear Syringing

The presence of a perforation is a contraindication. Unfortunately, many patients are unaware of the perforation and it may not be identified until after the ear has
been syringed. If necessary a systemic antibiotic should be administered systematically. Otitis externa is usually regarded as a contraindication because water can aggravate it. Nevertheless, many experienced doctors still syringe the ears when this condition is present but would always be careful gently to mop the meatus dry and might also instill some steroid drops (for example, betamethasone valerate lotion) twice daily for three to four days after syringing.

Wax in the ears of children poses special problems. Syringing the ears in a child is never easy and is particularly difficult when the child is ill. Nor is the procedure free from risk of trauma, especially if the child is irritated.

**Equipment**

*Syringe:* Most ear syringes are about 18cm long excluding the nozzle and hold 120ml of water. Shorter syringes are also available. Although they hold less water, they are easier to balance. Alternatively, a Higginson’s syringe may be used. Sterility is not necessary.

*Water:* Plain tap water may be used and should be at or slightly above body temperature. The use of sodium bicarbonate in the water is not essential. Water that is too cold will stimulate the semicircular canals and may cause vertigo, nausea and vomiting.

*Towels:* Traditionally, a rubber or plastic apron is wrapped round the patient’s neck to protect his clothes. The cost of laundering cloth towels normally prohibits their use, but paper towels are a satisfactory substitute. They may be tucked inside the collar and will soak up most, if not all, of any water that spills.

*Collecting bucket:* A Noot’s tank is the most convenient, but if it is not available a kidney dish will do. The main disadvantage of the kidney dish is its habit of tipping over when partly full.

*Wax hook:* A wax hook (Jobson-Horne) is useful to lift out a plug of wax that remains obstinately in sight but keeps falling back or one that is stuck to the side wall of the meatus. In most patients experienced operators can remove all the ear wax with a hook without resorting to syringing.

*Lighting:* A source of light, either a battery auriscope or a lamp, speculum, and head mirror, is essential for examining the ear before, during, and after the procedure. If a wax hook is to be used in the depth of the external auditory meatus a head mirror and speculum have an advantage over an electric auriscope in leaving one hand completely free to manipulate the hook.
Wax-softening agents: It is usually possible to syringe wax from an ear without any preparation, but first softening the wax eases the process. Sodium bicarbonate ear drops are effective. Alternatively, olive or almond oil may be used. After any of these have been used for two to five days, syringing can sometimes be avoided.

Recommendations before Procedure

The following instructions are recommended:

- Before going to bed, some olive or almond oil may be warmed to body temperature.
- Using a teaspoon and holding the head on one side the oil may be dribbled into the affected ear.
- The oil is allowed to drain into the ear properly before straightening the head again.
- The ear is plugged with a large piece of cotton wool.
- If necessary the procedure may be repeated with the other ear.

This procedure should be done for at least 3 consecutive nights. If the wax has not cleared naturally by then, syringing is appropriate. Alternatively, an immediate attempt to remove the wax may be made with a hook or by syringing the ear without preparation. There is some evidence that using a solvent solution even half an hour before syringing may offer some benefit.

Procedure

The patient should sit comfortably in a chair; a paper towel or plastic apron should be wrapped round his neck. The patient's co-operation is highly desirable if the meatus and drum are not to be damaged and water is not to be squirted all over the patient, the operator, and the rest of the room. The patient should be asked to hold the Noot's tank below the ear, slotting the lobe into the groove. It is easier if the patient holds the tank to the right ear with the left hand and vice versa. This also reduces the risk of the patient knocking the operator's arm away. When all is ready the syringe should be filled with water. It should be ascertained that, no air remains in the syringe, as the sound of bubbles may be frightening to the patient. The pinna should be pulled up the back to straighten the external auditory meatus, pointed in the direction of the eardrum but slightly backward and downward (towards the patient's occiput).

Some operators squirt the water in short bursts, others empty each syringeful in one or two actions. The jet of water should pass behind the wax and return into the tank. Sooner or later it will bring with it the lump of wax either intact or in fragments (often several large fragments: hence the need to inspect the ear during the procedure to ensure that all the wax has been cleared).
Water remaining in the meatus will restrict the view and should be gently mopped out with a pledget of cotton wool or paper tissue, but the ear drum should not be damaged in trying to make sure that the ear is perfectly dry. A small pledge of cotton wool may be left between the tragus and antitragus to mop up the last drops, but the meatus should not be blocked. When the first ear has been freed of wax the patient should be turned round slowly in his chair (rapid movement may make him giddy) and proceeding should be in the same way with the other ear.

**Complications**

The most experienced operators sometimes fail to remove all the wax, even in the most co-operative patient and after using a softening agent. If the wax cannot be removed first time, the patient should continue to use the softening agent for at least another seven days before repeating the procedure. If the meatus is scratched it will bleed. This is particularly likely to occur if a wax hook is used. The blood should be gently mopped up with cotton wool. Otitis externa is always a risk, but this may be reduced by careful drying. If an already affected meatus is syringed, the local application of steroid drops for one or two days after syringing reduces the risk of any further exacerbation.

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**Prevention of Complications**

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<th>Decision</th>
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<td>Is all the wax removed?</td>
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<td>Softening agent should be used for at least 7 days</td>
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<td>The ear should be syringed again</td>
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<td>Is all wax removed?</td>
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<td>No</td>
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<td>More experienced operator should be asked to try</td>
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<td>The patient should be referred to ENT surgeon</td>
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Intravenous Urography

Intravenous urography is a test which X-rays the urinary system using intravenous dye for diagnostic purposes. It is the most commonly performed radiological examination of the urinary tract. Of the many ways to obtain images of the urinary system, the intravenous injection of a contrast agent has been traditionally considered the best. The kidneys excrete the dye into the urine. Then X-rays can create a picture of every structure through which the urine passes. The information obtained is primarily anatomical, as the examination provides only a crude assessment of renal function. It is however, highly accurate in delineating the size and shape of the kidneys, calices and ureters. The procedure has several variations and many names such as: Intravenous pyelography (IVP), Urography, Pyelography, Excretory urography etc.

This procedure yields information about most of the disease of the kidneys, ureters and bladder which actually has two phases; it requires a functioning kidney to filter the dye out of the blood into the urine. The time required for the dye to appear on X-rays correlates accurately with kidney function. The second phase gives detailed anatomical images of the urinary tract. Within the first few minutes the dye 'lights up' the kidneys, a phase called the nephrogram. Subsequent pictures follow the dye down the ureters and bladder. A final film taken after urinating reveals how well the bladder empties.

Indications

Intravenous urography is used to pinpoint most of the diseases and abnormalities of the kidneys, ureters and bladder:

- To detect kidney stones
- To assess renal blood flow
- To detect outlet obstruction
- To detect tumors and congenital malformations of urinary system
- To detect kidney cysts and cancers
- To visualize any displacement of the kidney or ureter by space-occupying lesion like a cancer
- To detect any abnormality where the ureters enter the bladder
- To outline bladder cancers and other abnormalities of the bladder
- To detect an enlarged prostate gland as it shows up as incomplete bladder emptying and a bump at the bottom of the bladder
Contraindications

No absolute contraindications to urography exist but caution should be undertaken in the following groups:

- Patients with known sensitivity to radiological contrast media
- Patients with renal failure: Transient rises in serum creatinine concentrations after high-dose urography have occurred. Care is particularly important in patients with diabetes mellitus and even mild renal failure
- Patients with multiple myelomatosis
- Neonates
- Pregnant women

Types of Contrast Media

The media in use are the sodium and meglumine salts of tri-iodinated organic compounds, which are remarkably safe. The choice of contrast medium will vary among radiology departments. There appears to be very little difference in the quality of the X-ray image obtained whether the sodium or meglumine salts are used. Generally in patients with heart failure, it is advisable to avoid giving sodium ions (eg. Sodium iothalamate) and therefore to choose instead a meglumine salt (eg. Meglumine iothalamate). Nevertheless, a small risk of hypersensitivity reaction exists and urography should not be undertaken unless equipment and drugs necessary for full resuscitation are readily available. Inquiry about a history of any allergy is always necessary, as the incidence of reactions is increased in atopic patients. Pretesting with small doses of media is now regarded as useless, but in high-risk patients premedication with corticosteroids is necessary, preferably during the 24 hours before the examination.

Procedure

Careful selection is essential in all these patients, and the radiologist will often suggest alternative and safer procedure such as ultrasonography or isotope renography. For example, when ureteric or bladder-neck obstruction is suspected then ultrasonography will invariably confirm or refute this possibility. When excretion urography is regarded as essential in multiple myeloma or renal failure, then the patient should be well hydrated before the procedure. In renal failure dehydration may result in severe volume depletion, electrolyte imbalance, and
the 'no fluids' instruction on the ward. There is often a delay before urography is performed, which can effectively result in a dehydrated patient. It is important that the radiologist and referring clinician make arrangements to see that such inadvertent dehydration does not occur. The possibility of irradiating an unsuspected fetus is minimized if the X-ray Department institutes the '10 day rule'—that is, women of reproductive age (12-50 years) will be booked for urography only during the first 10 days of their menstrual cycle.

Procedure in adults

The basic procedure considered here may be modified according to the individual clinical problem. Laxatives are administered for two consecutive nights to remove feces from overlying the kidneys. Dehydration increases the renal concentration of the contrast medium and improves opacification of the pelivalvical systems. Fluids are therefore withheld for 12 hours before urography.

After entering the X-ray Department the patient empties his bladder, and a control abdominal film is obtained. This will show opaque calculi and also permits adjustment of the radiographic technique. The patient is always placed supine before the injection of contrast media because of the risk of hypotension. In addition he must not be left unattended during the 20 minutes after injection so that any reaction may be detected and treated without any delay. Contrast injected as rapid bolus to obtain the high serum concentration necessary for a dense nephrogram shows the outline of the kidneys immediately at the end of the injection. This film reduces the necessity for tomography or oblique views, which might otherwise be required to show the precise outline or size of the kidneys.

A second film is taken five minutes later to show early filling of the calices. Abdominal compression is then applied (though not after recent abdominal surgery, acute abdominal pain, or suspected ureteric colic) to compress the ureters and distend the calices. A further radiograph of the renal areas is obtained.

<table>
<thead>
<tr>
<th>Suggested Doses of Contrast Medium According to Patient's Age</th>
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<tr>
<td><strong>Age</strong></td>
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<tr>
<td>Adults:</td>
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<tr>
<td>Routine</td>
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<tr>
<td>Renal failure</td>
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<td>Children:</td>
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<tr>
<td>8-12 years</td>
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<td>4-8 years</td>
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<td>&lt;4 years</td>
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at 10 minutes primarily to show the calices and renal pelvis. Compression is released at 20 minutes and a full-length film is immediately obtained to show the ureters and bladder. Films of the bladder after micturition are taken only when assessing obstruction of the bladder neck. They are not indicated as a routine procedure, particularly in women.

Procedure in children

In children, infants and neonates a different approach is required. The volume of contrast is reduced in relation to body weight, the number of exposures reduced to a minimum, and gonad protection taken whenever possible. The clinical indications for urography in neonates are few, and when the procedure is indicated isotopes or ultrasonography will usually and more safely solve the clinical problem. These investigations should precede urography in neonates in most instances. In children under 4 years of age, a meglumine salt is chosen to avoid the hazards of hypernatremia, and the contrast medium should be injected slowly over several minutes to avoid a sudden rise in plasma osmolarity. In older children 8 hours of dehydration suffices and the volumes of contrast is reduced.

Special circumstances

In certain circumstances the standard procedure for intravenous urography must be altered. Renal failure and multiple myeloma have already been mentioned, and the need for careful selection is emphasized. When urography is regarded as essential in renal failure, then the dose of contrast medium is modified to 2ml meglumine iothalamate/kg, and tomography should be routinely available to help delineate the poorly opacified calices and renal parenchyma.

In acute renal colic the investigation is performed without preparation. Abdominal compression is not applied, and two films - a control and a 10 minute film are often sufficient to confirm or exclude the diagnosis. When a renal tumor is suspected then a modified dose of contrast medium (e.g., 2ml meglumine iothalamate/kg) with immediate nephrotomography will disclose or exclude a mass and usually distinguish between a simple cyst and a hypernephroma.

Factors Affecting Results

- Bowel gas
- Obesity
- Poor kidney function that prevents the kidneys from concentrating the dye from the blood stream and 'lighting up'
- Failure to fast before the test
Complications

Death due to a reaction to contrast media is rare, the incidence being about one in 50000. Adverse reactions of various types and severity occur in 5-8% of patients, but fewer than 2% of these are clinically important. Reactions occur usually within the first 10 minutes after injection but occasionally are delayed. They are mostly mild and include sneezing, pruritus, hives and minor bronchospasm. When treatment is required an antihistamine, administered intravenously, usually induces a rapid symptomatic response. Severe reactions, including cardiac arrest, are extremely rare but do occur. The X-ray Department must always have facilities and a protocol available for immediate resuscitation.
Setting up a Drip

It is essential practical skill for a medical practitioner and must often be performed quickly in life threatening situations such as cardiac arrest or serious hemorrhage.

Indications

The many indications for setting up a drip fall into three main groups:

• To introduce or replace fluids into the circulation- for example, blood, blood fractions, colloids or electrolyte solutions
• To provide a route for administering parenteral medication or nutrition, usually in intensive care
• To permit monitoring of central venous pressure. In this case a long flexible catheter is used to reach along the peripheral vein into the vena cava

Precautions

No absolute contraindications exit, but particular care is necessary under certain circumstances:

• If heart failure is present or incipient an extra circulating fluid load may result in severe pulmonary edema. In this situation if a blood transfusion or intravenous infusion is required, diuretics should be given simultaneously
• In renal failure it is important that the fluid and electrolyte loads, as well as the amount of drugs given, do not exceed the excretory capabilities of the kidneys
• If small veins with inadequate blood flow are cannulated, toxic or irritant substances may pool at the infusion site, causing inflammation or necrosis
• In patients with impaired immune responses or damaged heart valves a drip site is an important portal for the entry of potentially fatal infection. Strict attention to asepsis and restriction of the time for which the cannulae is in situ are necessary. If prolonged use of a long catheter (for example, Bovic or Hickman catheters) is expected, the outer end should be drawn through a skin "tunnel", so that the site of the skin puncture is several centimeters from the vein. The stab wounds are closed with a stich when the catheter is in position, and the giving-set connection outside the tunnel is strapped to the chest wall.

Equipment

• Sterile fluid and giving set
• Cannulae
• Alcohol swabs
• An adhesive tape
• Cotton wool balls
• Tourniquet
• Gloves
• A razor
• Plain 1% lignocaine
• 3ml syringe with a 25G needle

Sterile fluid and giving set: the fluid or blood is usually presented in the collapsible bags or bottles, but sometimes in rigid bottles, which need an air inlet to prevent a vacuum from forming when the fluid flows out. Fluid or giving sets that are not in sealed plastic or paper covers should be avoided as they may be dirty or have been tampered with.

To prepare the giving set, the adjustable value should be closed before pushing the connector firmly into the bag or bottle outlet. The drip chamber is squeezed to obtain a fluid level in it. The Luer connector should be raised, with its sterile cover above the fluid level and the valve is then opened. The fluid will fill the plastic tubing up to the level in the drip chamber, and by lowering the Luer connector to that level the whole tubing will be filled without the formation of bubbles. Any small bubbles will float to the fluid surfaces if the tube is held vertical and trapped sharply. The valve is now turned off, set it ready for use.

Cannulae (for example, Medicut, Venflon, Abbocatt): The size of cannulae depends on its uses. The lower the number the larger the cannulae size. Fluid resuscitation of a bleeding patient should be done using large bore cannulae (14G or 16G). Intravenous antibiotics for an elderly woman with fragile veins might only require a small bore cannulae- for example, 20G. In general a larger cannulae is better, remain patent for longer period, and suitable for elderly with fragile veins.

Adhesive tape: It is essential to ensure that the drip does not fall out after all the effort to put it in. It should be confirmed that the patient is not allergic to the tape. Bandage will help keep the drips in position and protect them from the prying fingers of children or confused patients.

Local anesthetic: Plain 1% lignocaine can be used. If anyone miss a vein and need to have another, then local anesthetic may help the patient cooperative. Creams containing lignocaine 2.5% and prilocaine 2.5% may be useful for children and adults who are needle phobic.

Gloves: Although gloves seem to make things more difficult initially, but should be practised to use because occasional spill blood may transmit some blood-borne infection.

Razor: Tape does not stick well to hairy skin, and shaving hairy areas can save the considerable discomfort of having hair torn out by the tape later.
Procedure

Choice of vein: The most convenient site is the left forearm (or the right in left-handed patient). This permits comfortable morbidity of the left arm and leaves the right free for writing, washing etc. veins at the elbow should be avoided, as the joint would then require immobilization to avoid repeated kinking of the cannulae or catheter with resulting fracture or leakage. The site may, however, be dictated by the availability of suitable veins. Leg veins may be used in restless patients, as it is easier to splint a dressing on the leg than the arm. The experienced operator may cannulate the jugular, subclavian, or saphenous vein, or a scalp vein in a baby. Veins are much easier to cannulate at a site where they penetrate fascia, or at a confluence, as they are then fixed and cannot roll sideways away from the needle point. The cephalic vein is extremely difficult to cannulate with a long catheter, since it is angled at the shoulder; the basilic vein is much easier.

Venepuncture: After clothes have been removed from the limb, a tourniquet should be applied to distend the veins. Careful sterile procedure is important, a generous area around the chosen site should be cleaned with isopropyl alcohol swabs or iodine in alcohol solution. Heavy hair growth should be shaved before this is done.

The cannulae should be inserted in a single motion through the skin and into the vein. It should be noted that the bevel of the needle is uppermost. Flashback of blood in the chamber at the proximal end of the cannulae indicates that the needle is in the vein. At this point the tip of the cannulae should be advanced for another millimeter so that all the bevel is within the vein. Then the plastic cannulae should be slid gently over the needle into the vein (the needle should remain still relative to the plastic cannulae). Initially this may appear to require three hands but it gets easier with practice. The tourniquet is removed and now the cannulae is in the vein but the needle is still within the plastic sheath. The needle is then removed by pressing finger on the vein over the cannulae tip so that blood does not back track out of the cannulae. Then either the white plastic cap provided on to the cannulae is put or it is connected to a prepared giving set and bag of fluid.

Fixing and dressing: The cannulae must be fixed securely, as movement may damage it and lead to leakage and inflammation. A crepe bandage may be applied overall and helps to warm the fluid as it flows towards the vein. Splint should be avoided if possible, as movement of the limb discourages stasis of blood and possible thrombosis.
The site should be examined daily for inflammation, as a skin puncture always allows micro-organisms to enter the tissues and hypertonic glucose and amino-acid solutions are excellent culture media. Adding 500 units of heparin to each 500ml of fluid infused reduces the incidence of catheter-associated sepsis. All sorts of cannulae should be resited at two or three day intervals before injection reaches the circulation. Giving sets should be removed after three or four days and immediately after a blood transfusion, as clot remains in the filter chamber and may harbor micro-organisms.

Problems

No veins are visible or palpable: The veins may be genuinely poor or thrombosed by previous use or attempts at cannulation. There are several ways to find a vein. Often invisible veins can be felt and, if a good vein is felt, one should be able to cannulate it. In contrast veins that can be seen but not felt are often difficult to cannulate. It will be more effective if the tourniquet is not so tight as to occlude arterial supply as well as venous drainage. Hanging the arm down and even placing it into a bowl of warm water for a few minutes can make veins appear because cold is a potent vasoconstrictor. Glyceryl trinitrate patches have been put on to the skin in an attempt to dilate veins. As a last resort veins in nonstandard sites-for example, the dorsum of the foot can be used. It should be borne in mind that good veins are not a fixed asset, they come and go surprisingly fast. Returning to a patient at a later time may reveal a pleasant surprise.

Rarely a “cut-down” technique may be performed. Here the vein is exposed by blunt dissection of subcutaneous tissues through a small incision and is cannulated under direct vision. Alternatively, an experienced operator may cannulate the subclavian or jugular vein.

Bruising, Bleeding and Missing: Failing to enter a vein is usually a matter of having the needle too superficial or deep. The needle is redirected accordingly. Occasionally veins are thrombosed and can be recognized by a hard, cord-like feel.

In case of elderly patients having fibrous or calcified veins, there is also a chance of failure to penetrate the vein. The tourniquet should be removed and pressure should be applied to the venepuncture site in case the vein is leaking. In some instances even after successful flash-back of blood the cannulae fails to advance with hematoma formation. Here the reason may be that only part of the bevel of the needle is in the vein or needle is not in the vein when advancing the plastic sheath.

Once the needle has been withdrawn down the cannulae it must not be advanced again because it can cut through the cannulae and cause embolization of a plastic fragment. The procedure should be restarted. Anesthetics do many venepunctures and may succeed when all others have failed.
Failure to flow: The causes may relate to the giving set or the cannulae. The giving set- A closed on-off valve, kinked tubing, or failure of the giving set to puncture the seal of the bag outlet (especially common with gelatin) should be excluded.

The cannulae- The tip of the cannulae may be up against a junction in the vein and may need to be withdrawn slightly. Alternatively, the cannulae may simply lie outside the vein and have "tissued".

Hitting the wrong things: Nerve damage or arterial puncture may happen occasionally, particularly in the antecubital fossa if the needle is too deep or if the patient is obese. If pain or paresthesia occur, or if arterial puncture is suspected, cannulae should be withdrawn and the puncture site should be pressed with a cotton wool ball for an appropriate time.

Appearance of inflammation: The cannulae must be resited, as local antiseptics or systemic antibiotics will be useless while a foreign body is in position. The cause of unexplained fever in the patient may be infection at the venepuncture site.

Difficult patients: Children and patients with a needle phobia should not have a cannulae inserted by beginners. Local anesthetic cream can be applied to the skin. Currently, a eutectic mixture of the local anesthetics lignocaine and prilocaine is used. Unfortunately, this cream may make the veins harder to find. As an alternative amethocaine gel is now available. This said to work more quickly, and dilates rather than constricts blood vessels.

High risk patients: All patients should be assumed to be at high risk since infection with bloodborne disease is often not known. Therefore gloves should be used regularly. Patient known to be infected especially with hepatitis viruses or HIV should be dealt with by experienced doctors.

Careful attention to sitting, dressing, and managing a drip can make the difference between well-being and misery for the patient, and is very rewarding for the little time that it takes.
Taking Blood and Putting up a Drip in Young Children

Blood may be obtained from young children by heel prick or thumb prick, but venepuncture is essential for blood culture, coagulation studies and tests requiring more than 1 ml of blood. Suitable superficial veins include the antecubital veins and those on the back of the wrist, the foot and the scalp. Using the external jugular vein is frightening for children. The internal jugular and femoral veins are potentially dangerous sites for venepuncture, as damage to adjacent structures may occur.

Capillary Blood Sampling

In babies under 6 months of age the heel is the ideal site for capillary blood sampling, but in older infants the thumb is better. The heel must be warm: if it is cold the foot is dipped into hand-warm water (40°C) for five minutes and then dried thoroughly. The foot is held by encircling the ball of the heel with the thumb and forefinger. A site on the side of the heel is selected, wiped with isopropyl alcohol, and allowed to dry. The ball or the back of the heel is not used because painful ulcer may form. A disposable lancet about 2mm is inserted and withdrawn, cutting very slightly sideways. The initial drop of blood is wiped away with a dry cotton swab and then the drops are let, to form and to fall into the container. The fingers are squeezed and released around the calf to milk blood into the heel. The heel is maintained below the rest of the lower leg. The container is agitated to mix the blood with anticoagulant. When the required volume has been obtained the heel is wiped and pressed with a clean cotton-wool ball. A small plaster such as a band-aid is applied.

Venepuncture

During venepuncture a nurse should hold and comfort the child. The arms should be examined under a good light. With manual compression round the upper arm the antecubital veins should be visible and palpable. With compression of the forearm and pronation and flexion of the wrist, veins should be visible and palpable on the back of the wrist. The antecubital veins are ideal because they are usually of a good size and are unlikely to be needed for later infusions.
because there is movement at the elbow. The skin is sterilized with an alcohol swab and allowed to dry. Povidone-iodine is used if the blood is to be cultured.

A 23G butterfly needle is suitable for venepuncture because it is large enough to provide good blood flow but thin enough for small veins. A Y-junction or an accessible straight vein is the best site to enter a vein. The butterfly needle is inserted 0.5cm distal to the planned point of entry into the vein. The needle is advanced under the skin until it is at the junction or on top of the vein and then the needle is inserted into the vein, making sure that the skin is stretched distally to stretch the vein and to prevent it from sliding away from the needle. Blood should flow into the tubing. The butterfly needle is taped in place with one strip of micropore 1.3cm (1/2 inch) tape. The cap is taken off the distal end of the butterfly-needle tube and connected to a syringe. Patience must be exercised when applying suction on the syringe, as overenthusiastic suction may stop blood flow altogether by pulling endothelium on to the end of the needle. With the butterfly needle taped to the skin, the syringe may be manipulated and changed without fear of dislodging the needle. When the required volume has been withdrawn the tape is removed, a cotton-wool gauze swab is applied to the vein, and the needle is gently withdrawn.

**Putting up a Drip**

Intravenous infusions are commonly needed in young children and infants for rehydration, drug treatment, inability to tolerate feeding and surgery. For infants under 1 year, and particularly the newborn, scalp veins are a reliable site for infusions. Sites for older children include the back of wrist, the forearm and the ankle.

Butterfly needles are commonly used in infants because they are easy to insert and immobilize, particularly on the scalp. They are not ideal for older infants and toddlers because they are apt to cut out vein after a short time. The alternative is to use a plastic cannulae. These are preferable for limb veins because they do not cut out of the vein even when there is some movement.

**Insertion of Intravenous Cannula**

For insertion of an intravenous cannula a nurse holds the child and a rubber tourniquet is applied proximal to the selected limb vein. A pediatric giving set with a burette, a suitable intravenous fluid and an intravenous infusion pump is assembled. The skin is sterilized over the vein with an alcohol swab and is allowed to dry. A puncture is made in the skin distal to the vein with a No.1 (21G) needle, a 22G needle catheter is then inserted through the puncture. The previous skin puncture permits easier manipulation of the needle catheter under the skin. The needle catheter is inserted into the vein. When blood flows back the shaft of the needle is held with the thumb and middle finger and the cannulae is
advanced with the forefinger. Alternatively, with the help of an assistant holding the limb, the shaft of the needle is held still with the left hand and the catheter is rotated, easing it forward over the end of the needle and into the vein for about 1cm. The needle is withdrawn. The catheter is gently rotated and inserted further if the vein allows. The blood flowing out of the catheter is checked. The giving set is connected, the tourniquet is taken off, and the drip flows with gravity without subcutaneous swelling is checked.

Fixation and Immobilization
There are many efficient ways of fixing an intravenous cannulae. A square of gauze is placed over the point of insertion into the skin and secured by tape. A loop of the giving line should be taped to the site of the limb. To immobilize the wrist or ankle of an infant a wooden splint may be taped to the limb. A vigorous child may pull the catheter out, and the whole limb should be covered by crepe bandage or tube gauze. The limb of a newborn infant may be splinted by using two wooden tongue depressors, but recently the use of metal finger splints (Zimmer) is impressive, which may be bent to the angle of the knee, ankle or wrist and retain their shape.

Scalp-Vein Infusion with Butterfly Needle
To the mother it must be explained that the needle is not going inside the skull, the procedure is painless after insertion, and the hair will grow back. If it is necessary, the hair is shaved on the temporoparietal area on one side. The vessel is palpated and the direction of blood flow is checked to ensure that a vein and not an artery will be infused. The frontal area may be suitable but the forehead is avoided, as extravasation of hypertonic fluids or calcium solutions may leave a scar.
A 23G butterfly needle is prepared by filling it with 0.9% sodium chloride solution. Strips of 1.3cm micropore tape and 1×10cm gauze impregnated with Plaster-of-Paris are cut. For very small veins short 25G needle is used. A tourniquet is made with an elastic band around the head proximal to the site of insertion. All but the smallest infants are immobilized by wrapping the arms in a blanket. A Y-junction or straight vein is selected. The needle is inserted above the vein. Blood should flow back along the tubing. A tiny vein may give very little blood flow but can support a useful infusion for a considerable time.

A strip of 1.3cm micropore tape is placed on the top of the needle. 0.5-1 ml of 0.9% sodium chloride solution is injected slowly and checked for subcutaneous swelling.

**Fixation and immobilization**- If the injection of fluid is satisfactory the wings of the needle is taped down and connected to the giving set, and that the fluid flows with gravity is checked. The rate may depend on the tangential angle between the needle and the scalp. Occasionally, flow into a very small vein may be so slow with 0.6-0.9m of gravity that no flow is visible. A test infusion with the pump is tried but caution is required regarding extravasation. Plaster-of-Paris gauze or cotton-wool may be packed under the wings to maintain the optimal angle for flow. Plaster-of-Paris gauze may then be spread over the wings, giving effective immobilization. A loop of giving set is taped or plastered to the scalp.

The butterfly needle should be protected but must be visible to detect extravasation. A plastic cup with two sections cut out gives protection while providing visibility and an exit for the infusion-fluid tube. The cup is taped over securely, covering up to half the head so that the baby can lie on that side. Three or four unsuccessful attempts usually means a colleague should be asked to try before all the useful veins are spoilt. Everyone misses sometimes, so nobody should feel too upset about failure.
Umbilical Catheterization

Umbilical catheterization is an invaluable tool in the care and management of the neonate requiring specialized care. This is a common procedure performed in the neonatal intensive care unit (NICU).

Indications

Neonates experiencing respiratory distress syndrome (RDS), persistent pulmonary hypertension (persistent fetal circulation), and the neonatal depression make up the vast majority of candidates for umbilical catheterization. This is the preferred site of vascular access during neonatal resuscitation.

Precautions

Sterile technique should always be adopted. The umbilical vein is cannulated, not the umbilical arteries. Catheter should not be inserted more than 6cm.

Equipment

- 5 French umbilical catheter or 2" 16 gauze I.V. catheter without needle
- Three-way stopcock
- Syringe
- Scalpel
- Disinfectant solution
- Crystalloid
- Sterile gauze pad
- Tape
- Umbilical tape or ligature
- Sterile drape

Procedure

After preparing all the equipments crystalloid filled syringe and three-way stopcock are attached to umbilical catheter and flushed. Sterile drapes are placed around the base of cord, establishing a sterile field. Mild ligature pressure is applied to umbilical cord near the skin to prevent bleeding. The cord is cut approximately 2cm from the skin, leaving a clean, smooth end. Catheter is inserted in the large, thin-walled, single vessel for 2cm, and then checked for blood return, if no blood return, advancing is kept in 1cm increments until blood
return or catheter has been inserted 6cm. Catheter should not be used if there is no blood return. After blood return, catheter is secured with tape and covered with gauze pad. Then it is frequently flushed with 1-2ml crystalloid. Although the procedure is relatively simple it is not without potential complications. So careful consideration of the neonate's medical requirements should be weighed against the possible complications.
Urethral Catheterization

Urethral catheterization is a frequently performed bed side procedure. It should not be undertaken lightly and be performed by staff who have been properly instructed. If it is done haphazardly it may lead to complication.

Indications

Intermittent catheterization

For diagnostic purposes:
- To measure residual urine or to introduce contrast media in radiography of urinary tract
- To obtain a catheterized specimen of urine for culture and sensitivity when specially required

For therapeutic purposes:
In the hypotonic, neurogenic, or decompensated bladder to permit adequate emptying, especially when managing chronic urinary tract infection.

Continuous catheterization
It may be short term to relieve acute or chronic retention of urine before prostatectomy, or long term when general poor health prevents prostatectomy (rarely) or in mental deterioration and urinary incontinence. It may also be very much useful to keep the patient manageable when the patient is obtundent or comatose and to watch hourly measurement of urinary output in intensive care unit (ICU) and coronary care unit (CCU).

Choice of Catheters
The choice of catheters depends on what is expected to get out. When the urine is expected to be clear and the catheter do not have to leave in afterwards, the choice should be the softest, narrowest and cheapest catheter available. The disposable Jagues catheter is quite suitable for this purpose. Indwelling catheters are usually retained by a balloon and should be biologically inert to prevent urethral irritation. Latex is usually well-tolerated, and the newer polyvinylchloride catheters are said to be non-irritant.

When blood clot or debris has to be washed out, a plastic or armoured latex catheter should be used, as this will not collapse when suction is applied. If
irrigation of the bladder is required a three-channel catheter is used, but it should be remembered that the third channel narrows the lumen of the catheter.

In retention a small Foley catheter of 12-14 French gauge will usually be suitable but in men with a large prostate or prominent bladder neck a smaller (8-10 French gauge) Gibbon catheter, which is more resilient, will often go in more easily. For long-term drainage a larger catheter (18-20 French gauge) made of silicon rubber should be used. These catheters are said to be more comfortable and require less frequent changing as fewer encrustation develop.

**Procedure**

Absolute asepsis in technique, adequate light, and the utmost care in passing the catheter is essential. Gloves and masks should be worn. The patient should be resting comfortably on his back on a table or bed, with his legs separated slightly to accommodate the sterile receptacle for the urine collection. Explanation of the procedure and reassurance should be provided to the patient. Sedatives can be given if required.

In men: The prepuce (if present) should be fully retracted and, together with the glans and separated meatus, is thoroughly cleansed with an antiseptic solution—e.g., 0.5% chlorhexidine or povidone. Sterile drapes are placed around the penis, which is wrapped in a sterile gauze swab soaked in the anti-septic solution. This makes the penis easier to hold and keeps the foreskin retracted during the procedure. A gel (15ml) containing 1% lignocaine and 0.5% chlorhexidine/or povidone should be introduced into the urethra and retained for five minutes by using a sterile pencil clamp. The lignocaine anesthetizes the urethra and lubricates it for passage of the catheter. It should be borne in mind that lignocaine is absorbed through the mucosa and should not be used in quantities of more than 15ml or strengths greater than 1%.

The catheter may be handled by the gloved hand, or advanced in a no-touch technique by using the inner polyethylene sheath in which the catheter is packed or by two pairs of forceps. The penis should be slightly stretched with the opposite hand to straighten out mucosal folds. No force should be used at any time.

Usually there is a little resistance to the catheter when its tip meets the external sphincter. It may help if the patient takes a deep breath, for as the patient breaths out the catheter can usually be gently pushed through the sphincter. Occasionally a prominent middle lobe of prostate or bladder neck will obstruct the catheter, and a curved catheter or introducer may be necessary to get over the hump.

The balloon of the catheter should be inflated with the appropriate volume of sterile water, and a specimen of urine is collected in a sterile container for bacteriological studies. Finally, the catheter should be connected to a closed
drainage system, thereby reducing the chance of subsequent infection.

Failure may be due to the presence of a urethral stricture or spasm of the external sphincter. If a small Gibbon catheter cannot be easily passed, more expert help should be sought.

In women and children: Nurses often perform catheterization in women and thereby, they should be taught the necessary technique. A good light is essential, as the urethral meatus tends to become more vaginal in post-menopausal, sexually inactive women and is occasionally difficult to find. The bladder neck is sometimes prominent and may be passed by directing the catheter tip slightly anteriorly.

Children require careful handling and may be helped by sedation. A small Gibbon catheter or infant feeding tube is often the most useful. Balloon catheters tend to produce bladder spasm and are not always well tolerated.

Aftercare and Complications

Organisms can enter the urinary tract from three sources once a catheter has been left indwelling: a) by retrograde spread from urine in the reservoir; b) by a break in the closed drainage system and c) from bacterial colonization of the urethral meatus. Growth of bacteria in the reservoir bag may be prevented introducing antiseptic into the bag. Breaks in the closed drainage system usually occur when the catheter is irrigated because of blood clot. It is essential that this should be done aseptically, otherwise infection will certainly follow. Bacterial colonization of the urethral meatus may be reduced by regular catheter toilet- that is, by cleansing the glans and adjacent catheter with antiseptic.

Traumatic catheterization with rupture of the urethra and the catheter tip placed outside the urethra or bladder will result in extravasation of urine with tissue necrosis and gangrene if unrecognized. This is a surgical emergency and requires expert surgical help. The complications of infection and bacteremia are difficult to eliminate, but good aseptic technique and careful monitoring of ward infections will help reduce their incidence.