



# Pulse

Volume 9

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Precious Globe



Effective Contraception, the basis of happy family



Global explosion, the result of failure to use Contraception

CONTRIBUTORY HEALTH SERVICES SCHEME



सत्यमेव जयते

Government of India

**BHABHA ATOMIC RESEARCH CENTRE**

Anushaktinagar, Mumbai - 400 094

# Ten steps to prevent anti-microbial resistance in hospitalized patients

## PREVENT INFECTION

- Vaccinate
- Get the catheters out

## DIAGNOSE AND TREAT INFECTION EFFECTIVELY

- Target the Pathogen
- Access the experts

## USE ANTIMICROBIALS WISELY

- Practice Antimicrobial Control
- Use local data
- Treat infection, not contamination
- Treat infection, not colonization
- Stop treatment when infection is cured or unlikely

## PREVENT TRANSMISSION

- Isolate the pathogen

**CDC Guidelines**



# Pulse

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## Author guidelines for contribution to PULSE

Certain guidelines for authors are recommended for inclusion of articles in PULSE.

It is essential to uniformly follow, as far as possible, a format which is broadly enumerated below:

1. Choice of topic / title to be governed by its relevance to the Medical Division's scope of work.
2. The importance / critical application of the subject.
3. Historical background (In brief).
4. Theoretical aspect (In brief) to facilitate understanding.
5. Present status with respect to Medical Division.
6. Interface with other disciplines, if any.
7. Specific contribution by the unit.
8. Enhancement / upgradation / future plans.
9. Conclusion.

The information / details taken from various text books, magazines, journals, Internet should be duly acknowledged as references.

Articles should be sent as Microsoft Word documents in both hard as well as soft copy forms to:

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*I happened to go through the Independence Day Special Issue of India Today, where I came across the fact that Homi Bhabha turned a chance meeting with J.R.D Tata into a proposal to Sir Dorabji Tata Trust which set the ball rolling for the nation's atomic energy programme. India Today has chosen Bhabha Atomic Research Centre as one of the India's finest institutions, in its 61<sup>st</sup> Independence Day Special Issue.*

*To quote, from this issue, Director, BARC, Dr. Srikumar Banerjee, " We don't sit in an ivory tower. We are among the few countries to have mastered the entire nuclear fuel cycle starting from the mining of uranium ore to treating nuclear waste for safe disposal ".*

*An analogy even closer to home, at the Medical Division of BARC, would be the computerisation system that has enabled seamless life cycle management of the patient and healthcare interaction. We are proud to be one of the few or may be the only institution in the country, where the medical fraternity has displayed agility and successful adaptation to the technology, that covers a wide range of services. This covers everything ranging from taking appointments for various services to the delivery of speciality care.*

*Two main focus areas of the current issue are contraception and surgical infections. As we are all aware that hospital infections are an important cause of morbidity, adding to prolonged hospital stay and subsequently to healthcare expenses. The most effective way to fight them is to prevent them. These efforts, commensurate with the CDC (Center for Disease Control) guidelines are constantly on. Our nursing staff has been contributing remarkably to the success of the ongoing Infection Control Programme. Our heartfelt gratitude to them.*

*The focus on contraception is specially dedicated to our young stakeholders. I believe the knowledge addressed herein would prove beneficial to them. Now there is availability of newer oral contraceptives with low estrogen/ only progesterone content. There are larger health benefits, in addition to full proof contraceptive effect.*

  
(Dr. Amrita Misri)

## Infection control



*Cleaning .....Matters!!!*

# SURGICAL INFECTIONS

**Dr. Nancy Khardori**

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Surgical infections contribute a significant portion of all infections treated in a hospital setting. They include infections that require surgical intervention for resolution as well as infections that follow an injury or surgical procedure. The mainstay of management of surgical infections is drainage, debridement or diversion – the so called “3D’s” of surgical infections. Appropriate antimicrobial management, although absolutely necessary, should be considered an adjunct to the removal of pus, necrotic tissue, foreign body and to the diversion of ongoing bacterial contamination. Frequent use of biomaterials including intravascular and urinary catheters add to the risk of infectious complications in surgical patients. Removal of these devices often becomes necessary for resolution of infections. This article provides an update on the diagnosis and management of serious/life threatening surgical infections following an anatomic order.

## 1. Focal Intracranial Infections

Focal intracranial infections are relatively rare but can lead to significant morbidity and mortality if the diagnosis is missed or delayed. Infections such as these can present in four different forms: i) Brain abscess – caused by infection within the brain parenchyma; ii) Subdural empyema forms between the dura and pia-arachnoid layer and can spread bilaterally and extensively; iii) Epidural abscess forms between the dura and skull and is usually contained due to the tight attachment of the dura to the skull periosteum; iv) Septic Thrombophlebitis of the dural venous sinuses. The venous supply to the face, ears, paranasal sinuses and the brain is extensive and complex. Venous blood drains through superficial and deep cerebral veins from the brain, scalp, nose, paranasal sinuses and ears. These veins drain into the

deep cerebral venous sinuses which in turn drain into the internal jugular vein. Both the venous sinuses and cerebral veins are duploic (valveless) and allow infection to spread in both directions depending on the pressure gradient. Occlusion may occur without obstructive symptoms because the collaterals are extensive.

**Brain abscess** – Although relatively rare, brain abscess is the most common focal suppurative intracranial process. They arise from

- i) Contiguous infections (otitis media, mastoiditis, sinusitis, dental infections.) The microbiology of such infections includes aerobic or anaerobic streptococci, *Bacteroides* species, Enterobacteriaceae (e.g. *Escherichia coli* and *Klebsiella pneumoniae*), *Staphylococcus aureus* and *Haemophilus* species;
- ii) Penetrating head injury or post neurosurgical infection. The most common organisms are *S. aureus*, *Streptococci*, Enterobacteriaceae, *Pseudomonas aeruginosa* and *Clostridium* species.
- iii) Hematogenous infection from distant sites of infection, e.g. congenital heart disease, lung abscess or empyema and bacterial endocarditis.

The microbiology will depend on the distant source of infection.

Magnetic resonance imaging with gadolinium is more sensitive and specific than contrast enhanced CT scan. Presumptive antimicrobial therapy is based on the potential risk factor for brain abscess. The timing and choice of surgical procedure is individualized and depends on the primary infection source, the number

and location of the abscess and the patient's neurologic status. Only a small select group of patients (where surgical intervention is not feasible) should be treated with antibiotic therapy alone.

**Subdural Empyema** – Subdural empyema is not an abscess because it develops in a preformed space. Paranasal sinus diseases, particularly frontal sinusitis is the most common cause followed by otitis media and mastoiditis. Microbiology is similar to that of brain abscess. In the pre-antibiotic era mortality was 100%. In the past three decades, a significant decline in mortality has occurred due to better antibiotic therapy, advanced neuroradiologic imaging and surgical intervention.

**Epidural Abscess**- Most epidural abscesses are spinal and the most common cause is *S. aureus*. Only 10% are intracranial. Risk factors for intracranial epidural abscess is the same as for subdural empyema. For both spinal and intracranial epidural abscess, neuro-surgical drainage and antibiotics are the mainstay of therapy.

**Septic Thrombosis of Dural Venous Sinuses**- They all involve spread of infection through the venous system or contiguous spread from osteomyelitis into the proximate dural sinus. Early and aggressive antibiotic therapy is the mainstay of treatment. Craniotomy has been associated with deterioration in neurologic status. Delayed surgical intervention may be needed for the source of infection.

## 2. Space Occupying and Life Threatening Infections of the Head, Neck and Mediastinum

These infections can be life threatening because of the closed spaces that they involve or from toxin production by the bacteria involved. The fascial planes allow the rapid spread of infection along paths of least resistance to other vital structures. Because of the anatomic continuity, the spectrum of microorganisms involved in various types of infections is similar. Indigenous oropharyngeal flora contains a wide variety of bacterial species and any one of them especially, the less common but more pathogenic can cause infections. Most of these infections are polymicrobial and should be treated as such. Infections of the deep cervical structures require

surgical intervention in addition to early and aggressive antibiotic therapy. They include Ludwig's angina (submandibular space infection), Lateral pharyngeal space infections, Retropharyngeal space infections and in some cases of Lemierre's Syndrome (jugular vein septic thrombophlebitis).

## 3. Pulmonary Infections

Lung infections that require surgical intervention are those involving cavitary disease and/or loculation of purulent material.

### Infections of the pleural space

Infections of the pleural space most commonly follow pneumonia accounting for 40 – 60% of all empyemas. Approximately 20% of empyemas are related to thoracotomies done for infections or non-infectious diseases. The remaining 4 to 10% follow trauma. Less commonly, empyema develops as a result of esophageal rupture, direct extension from head and neck infections and hematogenous seeding of an existing pleural effusion. "*Empyema Necessitans*" is generally a sequel of pulmonary actinomycosis referring to rupture of parietal pleura with drainage of pus from the chest wall. Pleural empyema is caused by a mixture of aerobic and anaerobic bacteria in about half the cases especially those secondary to sudiaphragmatic disease. In otherwise healthy adults with pneumonia the most common bacteria causing pleural empyema are *S. aureus*, *S. pneumoniae* and *S. pyogenes*- Recent reports on the efficacy of fibrinolytic therapy have been encouraging. Surgical options include thoracoscopy usually by VATS or full thoracotomy with decortication. The latter may be the surgical intervention of choice when treatment has been delayed and empyema is in organized stage.

**Lung Abscess**- Microbial infection that causes necrosis of the lung parenemyma producing one or more cavities results in lung abscess. Most lung abscesses occur as a complication of aspiration pneumonia and are polymicrobial mostly due to anaerobic bacteria that are normally present in the mouth. Hospitalized patients, especially those on mechanical ventilation, have *S. aureus*, *P. aeruginosa* and other gram negative organisms which may be a part of the oral flora and therefore of the lung abscess microbiology. Monomicrobial lung



abscess can occasionally be caused by *S. aureus*, *Klebsiella* species, *P. aeruginosa*, *Actinomyces* species, and *Nocardia* species. Other organisms that can cause lung abscesses include mycobacteria (e.g. *M. tuberculosis*), fungi (e.g. *Aspergillus* species) and parasites (e.g. *Paragonimus westermani* and *Entamoeba histolytica*). In contrast to other visceral abscesses, lung abscesses drain themselves through communication with large airways. This process creates the presence of air-fluid levels. Currently most patients with lung abscesses respond to appropriate antimicrobial therapy and surgical intervention is needed for 10 to 15% of patients who do not improve with medical management. Indications for lobectomy or pneumonectomy include large cavities (> 8cms), abscesses due to multi-resistant organisms, e.g. *P. aeruginosa*. More recently CT guided percutaneous

procedures. Whether spontaneous or post-operative, the hallmark of IAIs is acute peritonitis with or without subsequent abscess formation and with or without bloodstream infections. Because of the risks of dissemination and severe sepsis syndrome, IAIs are surgical as well as medical emergencies. Most intraabdominal/pelvic infections are caused by the indigenous gastrointestinal tract flora listed in Table 1. The majority of these infections involve aerobic as well as anaerobic bacteria. On an average, five organisms are grown from abdominal infections, three anaerobic and two aerobic. The most frequently isolated organisms are *Escherichia coli* and *Bacteroides fragilis*. Aerobic gram negative bacteria are involved in the initial process of acute peritonitis and systemic complications. However, if antimicrobial therapy does not include agents with anaerobic activity, anaerobes are primarily involved in the subsequent abscess formation.

Table 1

Intra-Abdominal Infections are Predominantly (>80%) Polymicrobial		
On average, 4 to 6 species are isolated per infection, including gram positive and gram negative aerobes and anaerobes		
Gram positive	Gram negative	Anaerobes
<i>Enterococcus</i>	<i>Escherichia coli</i>	<i>Bacteroides</i> spp
Group A <i>Streptococcus</i>	<i>Enterobacter</i> spp	<i>Bacteroides fragilis</i>
Other <i>Streptococci</i>	<i>Klebsiella</i> spp	<i>Clostridium perfringens</i>
	<i>Proteus</i> spp	<i>Eubacterium</i>
		<i>Fusobacterium</i> spp
		<i>Peptostreptococcus</i>

Appropriate management of IAIs consists of early diagnosis, restoration of physiological homeostasis, mechanical removal of microorganisms and the use of systemic antimicrobial therapy. Mechanical removal is accomplished by exploratory laparotomy or percutaneous drainage which together are referred to as operative or surgical management. The success of operative management

drainage has been used successfully in patients not responding to antimicrobial treatment alone.

including preoperative care is the major determinant of the ultimate success of treatment.

#### 4. Intra-abdominal (Pelvic Infections) IAIs

The overwhelming majority of infections in the abdomen require surgical intervention. In addition, all the abdominal procedures done for non-infection related diseases put the patients at risk for subsequent infectious complications. Infections in the first category include acute appendicitis, acute diverticulitis, acute cholangitis, severe acute pancreatitis followed by infected peripancreatitis necrosis, and perforated bowel. The second category of IAIs includes complications that follow traumatic injury, surgical procedures and endoscopic

#### 5. Necrotizing Soft Tissue Infections

Necrotizing soft tissue infections are medical and surgical emergencies. If not treated early and aggressively with a multidisciplinary approach, mortality rates can be as high as 75%.

Necrotizing fasciitis (NF). Necrotizing fasciitis is differentiated by cultures into two distinct types – Type I is caused by mixed anaerobic and facultative bacteria including Enterobacteriaceae and non-group A Streptococci. In Type II, group A Streptococci is isolated

alone or in combination with staphylococci. Risk factors for Necrotizing fasciitis include Diabetes mellitus, peripheral vascular disease, intravenous drug use, obesity and malnutrition. The presence of marked systemic toxicity, severe pain out of proportion to the local findings should suggest the diagnosis. The affected area is initially red, hot and swollen without sharp margins and very tender. The process progresses over 2 – 3 days with color changing to blue-gray, ill defined patches. Next (3 – 5 days) cutaneous bullae and necrosis occur. Necrotizing fasciitis can affect any part of the body but is more common on the extremities (Figs. 1–4). Perineal involvement and necrotizing fasciitis involving male genital organs is referred to as Fournier’s



Fig.1 Right Arm skin necrosis - Bulbous lesions in Necrotizing Fasciitis



Fig.2 Right arm – Deep seated necrosis in Necrotizing Fasciitis seen at surgery



Fig.3 Right arm – disarticulation of the arm done to control infection



Fig.4 Right arm – Amputated for Necrotizing Fasciitis

gangrene. Necrotizing fasciitis is usually acquired through skin breaks (noticed or unnoticed), injection drug use and other skin lesions including varicella. It can occur as a post-surgical complication, most commonly after abdominal surgery. Obstetrical events including vaginal delivery with episiotomy and cesarean section and can rarely be complicated by necrotizing fasciitis. Immediate and aggressive surgical debridement is essential in addition to antibiotics and supportive care.

**Clostridial Myonecrosis (CM)** Clostridial myonecrosis also referred to as gas gangrene and is a fulminant skeletal muscle infection caused by toxin-producing clostridia, the most common being *Clostridium perfringens*. They

are associated with gas production in the muscle and crepitus. Clostridial myonecrosis used to be a deadly complication of contaminated war wounds in the pre-antibiotic era. Clostridial myonecrosis can be classified into three major groups: posttraumatic, postoperative and spontaneous (Figs. 5–8). Spontaneous Clostridial myonecrosis is often associated with occult or overt malignancy and is caused by *Clostridium septicum*. A triad of pain, which may be severe, tachycardia out of proportion to fever and crepitus, strongly suggest Clostridial myonecrosis. Skin discoloration, mottling, edema and multiple bullae with profuse serosanguineous drainage are typical.

Surgical debridement and antibiotics are essential in treatment. The goal of surgical intervention is to remove

all necrotic tissue and achieve hemostasis. A second look procedure may be needed 12 to 24 hours later. Limb amputation may be needed as a life saving procedure.

Although Clostridium species are highly sensitive to penicillin, broader spectrum antimicrobial therapy is usually used in these potentially fatal infections because of the potential of mixed infection and superinfection.

### Selection of Antimicrobial Therapy for Surgical Infections

The current challenges to the selection of antimicrobial therapy in severely ill patients with surgical infections include i) polymicrobial nature of many of these infections; ii) escalating antimicrobial resistance in most



Fig.5 Clostridial Myonecrosis after cholecystectomy



Fig.6 Clostridial Myonecrosis - After blunt trauma



Fig.7 Clostridial Myonecrosis - Air in muscles



Fig.8 Clostridial Myonecrosis gram positive bacilli (no WBC) on gram stain of sero-sanguinous discharge

**Table 2 - Antibiotics Used for Major Classes of Bacteria**

Gram Positive	Enterococci	Gram Negatives	Anaerobes
Penicillins** 1 <sup>st</sup> and 2 <sup>nd</sup> Generations e.g. Penicillin, Oxacillin, Ampicillin, Amoxicillin	Penicillins e.g. Ampicillin	Penicillins** 3 <sup>rd</sup> and 4 <sup>th</sup> Generations e.g. Ticarcillin and Piperacillin	Penicillins - All
Cephalosporins 1 <sup>st</sup> Generation e.g. Cefazoli, Cephalexin		Cephalosporins** 3 <sup>rd</sup> and 4 <sup>th</sup> Generations e.g. Cefotaxime, Ceftaxidime and Cefepime	
Quinolones (new)* e.g. Levofloxacin		Quinolones (Old) e.g. Ciprofloxacin	Quinolones (New) e.g. Moxifloxacin
β-Lactamase Inhibitor** Combinations e.g. Ampicillin/Sulbactam, Piperacillin/Tazobactam	β-Lactamase Inhibitor** Combinations e.g. Ampicillin/Sulbactam	β-Lactamase Inhibitor** Combinations e.g. Piperacillin/Tazobactam	β-Lactamase Inhibitor** Combinations - All
Carbapenems** e.g. Imipenem, Meropenem and Ertopenem, Doripenem	Carbapenems*** Except <i>E. faecium</i>	Carbapenems***	Carbapenems
Vancomycin** Vancomycin Alternates e.g. Synercid, Linezolid, Daptomycin, Tygecycline	Vancomycin** Vancomycin Alternates		
Clindamycin			Clindamycin
Aminoglycosides Synergy Rifampin Synergy	Aminoglycosides Synergy	Aminoglycosides Synergy	Metronidazole**
* <i>S. pneumoniae</i> ** Penetrate the Blood-Brain barrier, useful for CNS infections *** Ertopenem has no activity against Enterococci and <i>P. aeruginosa</i>			

major groups of bacteria and iii) gaps in the coverage of available antimicrobial agents. Selection of presumptive (before culture results are available) antimicrobial therapy should take into consideration the spectrum of activity, bactericidal mechanism of action, pharmacokinetic properties and interaction with other

drugs. Antibiotics effective for major classes of bacteria are grouped in Table 2.

Because of the increasing multi-drug resistance in *S. aureus* and other gram positive organisms, a number of alternatives to vancomycin have been developed recently.

Since most surgical infections reviewed in this manuscript are polymicrobial, it is important to select coverage against all potential pathogens. B-lactamase inhibitor combinations, e.g. Piperacillin-Tazobactam and Carbapenems like Meropenem, have polymicrobial coverage (aerobic and anaerobic) (Table 4). However, the possibility of methicillin resistant *S. aureus* (MRSA) makes the addition of vancomycin or vancomycin alternates necessary. Tigecycline has activity against resistant gram positive organisms including MRSA, anaerobic bacteria and gram negative organisms except *P. aeruginosa* and *Proteus* species. Aminoglycosides or Rifampin should be added for synergistic activity. Once the culture and sensitivity results

Table 3

Antibiotics Used for Major Classes of Bacteria	
Vancomycin Alternates	
*Quinopristin-Dalfopristin (Synercid®)	Staphylococci Streptococci Enterococci
*Linezolid	Staphylococci Streptococci Enterococci
*Daptomycin	Staphylococci Streptococci Enterococci
*Tigecycline**	Staphylococci Streptococci Enterococci
*Includes Multi Drug Resistant (MDR) gram positive organisms	
**Also has activity against anaerobes and gram negative aerobic organisms except <i>P. aeruginosa</i> and <i>Proteus</i> species.	

Table 4

Antibiotics with Polymicrobial Coverage	
β-lactamase combinations	Ampicillin + Sulbactams
	Pip + Tazobactam
Carbapenems	Imipenem
	Meropenem
	Doripenem
	Ertapenem
Tigecycline	

become available, antibiotic therapy should be de-escalated to include the spectrum against grown pathogen and streamlined to exclude the agents not needed. Presumptive antifungal therapy should be considered in patients with i) infections related to GI tract; ii) history of broad spectrum antibacterial therapy; iii) intravascular catheters and iv) total parenteral nutrition. The appropriate duration of antibiotic therapy for serious surgical infections ranges from 4 – 6 weeks initially. However, in addition to clinical response, need for further antibiotic therapy should be evaluated by radiographic procedures (CT scan, MRI scan). The findings of the scans should also be used to determine the need for further surgical intervention.

### Additional Reading

1. Cheadle, W.G. *Risk factors for surgical site infection. Surgical Infections, Vol7, Supp 1, 2006.*
2. Khardori, N. *Antibiotics – past, present and future. The Medical Clinics of North America,90, 2006.*
3. *Treatment Guidelines from the Medical Letter. Ed. Mark Abramowicz. Antimicrobial Prophylaxis for Surgery, Vol. 4 (Issue 52), 2006.*

# APPLICATION OF IONIZING RADIATION IN MEDICINE

**Dr. S.P. Agarwal**

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Ionizing radiation is a fact of life. We live in a world in which radiation is naturally present everywhere. All life on the earth has evolved in the presence of this radiation. Radioactive materials occur naturally throughout the environment and our bodies contain radioactive material such as carbon-14, potassium-40 and polonium-210 naturally.

Since the discovery of x-rays and radioactivity more than 100 years ago, we have found ways of producing radiation and radioactive materials *artificially*. Within 6 months of discovery of x-rays, first use of x-rays was made in medical diagnosis. So benefit from the use of ionizing radiation, henceforth will be referred as radiation, was established very early and since then many different applications of radiation and radioactive materials have been developed for societal benefit.

Society is deriving immense benefits from the use of radiation in medicine, industry and research. In medicine, radiation is used for diagnosis and therapeutic purposes whereas in industry it is used as a quality tool in NDT and for process control such as gauging devices. The use of radiation for sterilization of medical products and food irradiation is also very widely used. In this lecture, the focus is on the use of radiation for societal benefits in medicine.

Radiation has two very different uses in medicine – for diagnosis and therapy. Most people at some time in their lives have an x-ray examination to help physician diagnose disease or damage in the body. A much less common diagnostic procedure involves administration of radionuclides to patients and detectors are used outside the body to get the required image. Use of pharmaceuticals labelled with radionuclides for diagnosis or therapy is called nuclear medicine. In diagnostic procedure very small doses of radiation are received by the patient. For the treatment of malignant diseases or

malfunctioning organs, much higher radiation doses through external radiation beams are given and this treatment is known as radiotherapy. In this talk, all the three applications of radiation i.e. radiotherapy, nuclear medicine and radiology are covered.

## Radiotherapy

Radiation therapy (or radiotherapy) is the medical use of ionizing radiation as part of cancer treatment to control malignant cells (not to be confused with radiology, the use of radiation in medical imaging and diagnosis). Radiotherapy may be used for curative or adjuvant cancer treatment. It is used as palliative treatment (where cure is not possible and the aim is for local disease control or symptomatic relief) or as therapeutic treatment (where the therapy has survival benefit but is not curative). Total Body Irradiation (TBI) is a radiotherapy technique used to prepare the body to receive a bone marrow transplant. Radiotherapy has a few applications in non-malignant conditions, such as the treatment of trigeminal neuralgia, severe thyroid eye disease, pterygium, prevention of keloid scar growth, and prevention of heterotopic bone formation. The use of radiotherapy in non-malignant conditions is limited partly by worries about the risk of radiation-induced cancers.

Radiotherapy is commonly used for the treatment of malignant tumors (cancer), and may be used as the primary therapy. It is also common to combine radiotherapy with surgery, chemotherapy, hormone therapy or some mixture of the three. Most common cancer types can be treated with radiotherapy in some way. The precise treatment intent (curative, adjuvant, neoadjuvant, therapeutic, or palliative) will depend on the tumour type, location, and stage, as well as the general health of the patient.

Radiation therapy is commonly applied to the tumour. The radiation fields may also include the draining lymph nodes if they are clinically or radiologically involved with tumour, or if there is thought to be a risk of subclinical malignant spread. It is necessary to include a margin of normal tissue around the tumour to allow for uncertainties in daily set-up and internal tumor motion. These uncertainties can be caused by internal movement (for example, respiration and bladder filling) and movement of external skin marks relative to the tumour position.

To spare normal tissues (such as skin or organs which radiation must pass through in order to treat the tumour), shaped radiation beams are aimed from several angles of exposure to intersect at the tumour, providing a much larger absorbed dose there, than in the surrounding, healthy tissue.

Every year large number of cancer patients are treated with radiotherapy, chemotherapy and surgery. Radiotherapy treatment is given to about half of all patients, with intent to cure the cancer or to alleviate suffering. The radiation may be given in the form of external beam radiotherapy of high-energy electrons or X-rays, or it may come from radioactive sources placed inside the patient (brachytherapy, nuclear medicine). For radiotherapy to effect a cure, it is essential that the correct amount of radiation (absorbed dose) be delivered to the patient. Too small a dose, and one or more cancerous cells may survive, leading to recurrence of the disease. Too large a dose, and the healthy tissue surrounding the tumour may be destroyed. Optimal treatment of, for example, some head and neck tumors, requires that the dose delivered should be within only a few percent of that prescribed.

Every treatment is monitored with instruments whose calibration can be traced back, via accurate secondary standard dosimeters, to the primary standard instruments held at national standards laboratories such as BARC. These standards measure absorbed dose or air kerma directly from first principles, and are subject to regular comparisons with other national standards worldwide. Reference instruments are calibrated against these primary standards in order to allow the determination of absorbed dose by following the relevant Codes of Practice recommended. Accurate dosimetry is essential

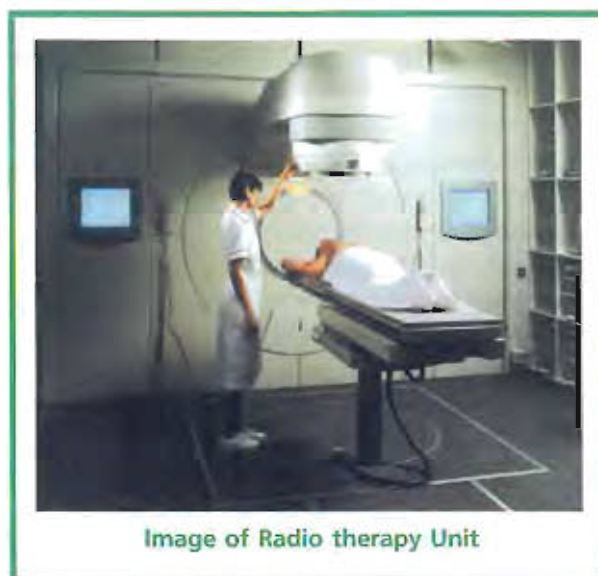


Image of Radio therapy Unit

to maintain and improve radiotherapy and ultimately to improve cancer survival rates.

## Nuclear Medicine

Nuclear medicine is a branch of medicine and medical imaging that uses the nuclear properties of matter in diagnosis and therapy. Many procedures in nuclear medicine use pharmaceuticals that have been labeled with radionuclides (radiopharmaceuticals). In diagnosis, radioactive substances are administered to patients and the radiation emitted is measured. The majority of these diagnostic tests involve the formation of an image using a gamma camera. Imaging may also be referred to as **radionuclide imaging** or **nuclear scintigraphy**. Other diagnostic tests use probes to acquire measurements from parts of the body, or counters for the measurement of samples taken from the patient. In therapy, radionuclides are administered to treat disease or provide palliative pain relief. For example, administration of Iodine-131 is often used for the treatment of thyrotoxicosis and thyroid cancer.

Nuclear medicine differs from most other imaging modalities in that the tests primarily show the physiological function of the system being investigated as opposed to the anatomy. In some centres, the nuclear medicine images can be superimposed on images from modalities such as CT or MRI to highlight the part of the body in which the radiopharmaceutical is

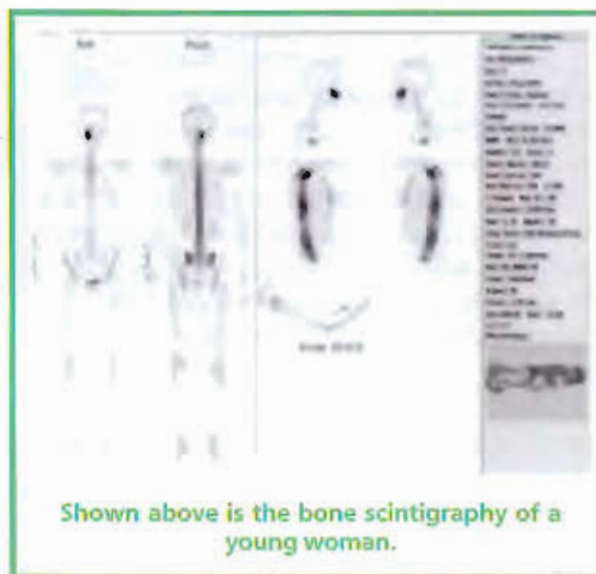
concentrated. This practice is often referred to as image fusion or co-registration.

Nuclear medicine diagnostic tests are usually provided by a dedicated department within a hospital and may include facilities for the preparation of radiopharmaceuticals. The specific name of a department can vary from hospital to hospital, with the most common names being the nuclear medicine department and the radioisotope department.

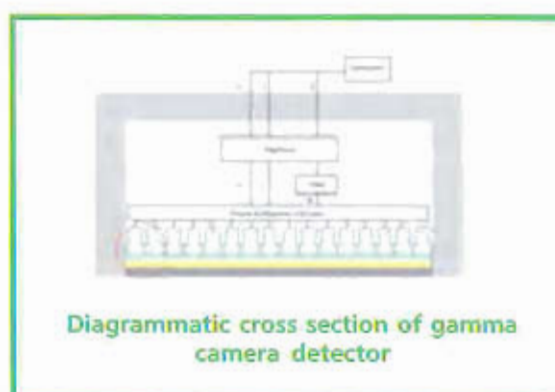
Diagnostic tests in nuclear medicine exploit the way that the body handles substances differently when there is disease or pathology present. The radionuclide introduced into the body is often chemically bound to a complex that acts characteristically within the body; this is commonly known as a tracer. In the presence of disease, a tracer will often be distributed around the body and/or processed differently. For example, the ligand methylene-diphosphonate (MDP) can be preferentially taken up by bone. By chemically attaching technetium-99m to MDP, radioactivity can be transported and attached to the bone via hydroxyapatite for imaging. Any increased physiological function, such as due to a fracture in the bone, will usually mean increased concentration of the tracer. This often results in the appearance of a 'hot-spot' which is a focal increase in radio-accumulation, or a general increase in radio-accumulation throughout the physiological system. Some disease processes result in the exclusion of a tracer, resulting in the appearance of a 'cold-spot'. Many tracer complexes have been developed, in order to image or treat many different organs, glands, and physiological processes. The types of tests can be split into two broad groups: *in-vivo* and *in-vitro*:

- *In-vivo* tests are measurements directly involving the patient. By far the most common are gamma camera imaging investigations, though non-imaging probes are also used to measure the levels of radioactivity within a patient.
- *In-vitro* tests are measurements of samples taken from the patient (e.g. blood, urine, breath).

A typical nuclear medicine study involves administration of a radionuclide into the body by injection in liquid or aggregate form, ingestion while combined with food,



### Imaging equipment



inhalation in gaseous form or, rarely, injection of a radionuclide that has undergone micro-encapsulation. Some specialist studies require the labeling of a patient's own cells with a radionuclide (leukocyte scintigraphy and red cell scintigraphy). Most diagnostic radionuclides emit gamma rays, while the cell-damaging properties of beta particles are used in therapeutic applications. Refined radionuclides for use in nuclear medicine are derived from fission or fusion processes in nuclear reactors, which produce radioisotopes with longer half-lives, or cyclotrons, which produce radioisotopes with shorter half-lives, or take advantage of natural decay processes in dedicated generators, i.e. Molybdenum/Technetium or Strontium/Rubidium.



The most commonly used liquid radionuclides are:

- Technetium-99m (technetium-99m)
- Iodine-123 and 131
- Thallium-201
- Gallium-67
- Fluorine-18
- Indium-111

The most commonly used gaseous/aerosol radionuclides are:

- Xenon-133
- Krypton-81m
- Technetium-99m Technegas®
- Technetium-99m DTPA

The radiation emitted from the radionuclide inside the body is usually detected using a gamma camera. Traditionally, gamma-cameras have consisted of a gamma-ray detector, such as a single large thallium-doped sodium iodide *Nal(Tl)* scintillation crystal, coupled with an imaging sub-system such as an array of photomultiplier tubes and associated electronics. Solid-state gamma-ray detectors are available [1], but are not yet commonplace. Gamma-cameras employ lead or tungsten collimators to form an image on the crystal, accepting photons arriving perpendicular to the camera face, and rejecting off-axis photons which would degrade the desired image.

Gamma-camera performance is usually a balance of spatial resolution against sensitivity. A typical gamma-camera will have a resolution of 4 to 6 mm and will be able to capture several hundred thousand gamma-ray 'events' per second. The gamma-camera detects the X and Y position of each gamma-ray event, using these coordinates to place a pixel in an image matrix to build a recognizable image. The units of a raw nuclear medicine image are 'counts' or 'kilocounts', referring to the number of gamma-ray events detected. In nuclear medicine, the value of an image pixel is the integral of gamma-ray events in that pixel position over time. That is, the pixel appears brighter as more counts are detected in that position. In non-tomographic images, the pixel

can also be thought of as the line integral of radionuclide distribution of a perpendicular line extending from the pixel position through the body of the patient. Activity closer to the camera face will produce more information in the image than activity located deeper in the body, however, because of attenuation by tissues between the radionuclide event and the camera face. Tomographic imaging applies similar principles, taking multiple planar images from different angles and then refining them using a process known as filtered back projection generating three dimensional views of organs or areas of interest.

Since each nuclear medicine radionuclide has a unique gamma-ray emission energy spectrum, and since the energy of a gamma-ray is detected in a gamma-camera by the brightness of the scintillation associated with an event, gamma-cameras employ energy 'windows' to gate or limit the imaging process to gamma-ray events of particular energies. An energy window is usually tailored to the peak, most often with a plus or minus ten percent window, of the energy spectrum of a particular radionuclide, thus ignoring other gamma-rays that would otherwise contribute noise to the image. This allows noise caused by Compton scattering to be gated out.

The end result of the nuclear medicine imaging process is a "dataset" comprising one or more images. In multi-image datasets the array of images may represent a time sequence (i.e. Cine or movie) often called a "dynamic" dataset, a cardiac gated time sequence, or a spatial sequence where the gamma-camera is moved relative to the patient. SPECT (Single Photon Emission Computed Tomography) is the process by which images acquired from a rotating gamma-camera are reconstructed to produce an image of a "slice" through the patient at a particular position. A collection of parallel slices form a slice-stack, a three-dimensional representation of the distribution of radionuclide in the patient.

The nuclear medicine computer may require millions of lines of source code to provide quantitative analysis packages for each of the specific imaging techniques available in nuclear medicine.

A patient undergoing a nuclear medicine procedure will receive a radiation dose. Under present international

guidelines it is assumed that any radiation dose, however small, presents a risk. The radiation doses delivered to a patient in a nuclear medicine investigation present a very small risk of inducing cancer. In this respect it is similar to the risk from X-ray investigations except that the dose is delivered internally rather than externally.

The radiation dose from a nuclear medicine investigation, is expressed as an effective dose with units of sieverts (usually given in millisieverts, mSv). The effective dose resulting from an investigation is influenced by the amount of radioactivity administered in megabecquerels (MBq), the physical properties of the radiopharmaceutical used, its distribution in the body and its rate of clearance from the body.

Effective doses can range from  $6\ \mu\text{Sv}$  (0.006 mSv) for a 3 MBq chromium-51 EDTA measurement of glomerular filtration rate to 37 mSv for a 150 MBq thallium-201 non-specific tumour imaging procedure. The common bone scan with 600 MBq of technetium-99m-MDP has an effective dose of 3 mSv.

## Radiology

Radiology is the medical specialty directing medical imaging technologies to diagnose and sometimes treat diseases. Originally it was the aspect of medical science dealing with the medical use of electromagnetic energy emitted by X-ray machines or other such radiation devices for the purpose of obtaining visual information as part of medical imaging. Radiology that involves use of x-ray is called roentgenology. Today, following extensive training, radiologists direct an array of imaging



Examination of an X-ray exposure of a patient

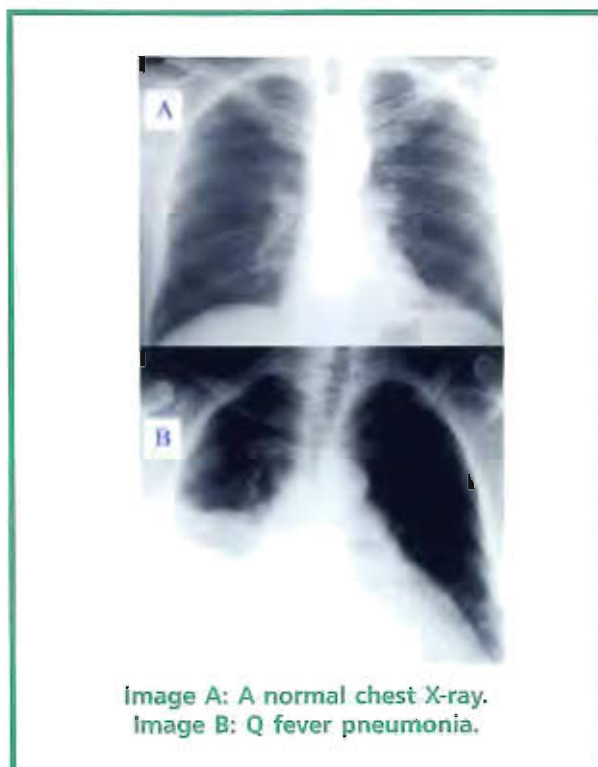


Image A: A normal chest X-ray.  
Image B: Q fever pneumonia.

technologies (such as ultrasound, computed tomography (CT) and magnetic resonance imaging) to diagnose or treat disease. Interventional radiology is the performance of (usually minimally invasive) medical procedures with the guidance of imaging technologies. The acquisition of medical imaging is usually carried out by the radiographer or radiologic technologist. Outside of the medical field, radiology also encompasses the examination of the inner structure of objects using X-rays or other penetrating radiation.

Radiology began with Wilhelm Conrad Röntgen's discovery of x-rays in 1895. It was such an important advance in medicine that within ten years radiology was being used all over the Western world. In 1901, Roentgen received the first Nobel Prize in Physics. In 1905 the first English book on chest radiography was published. During World War I, Maria Skłodowska-Curie pushed for the use of mobile radiography units for the treatment of wounded soldiers. She personally provided the radon tubes for the French Army. In 1920 the Society of Radiographers was formed. In 1924 Gilbert Stead published his *Elementary Physics for medical and radiology students*, helping bring radiology to the level of a generally recognized medical specialty. In 1937 a

patient with leukemia was treated at the University of California, Berkeley in the first therapeutic use of radioactivity for cancer. Also in 1937, Joseph Gilbert Hamilton started to use radioactive iodine as a diagnostic and therapeutic agent in the treatment of thyroid disease.

## Medical imaging

As a medical specialty, radiology can be classified broadly into Diagnostic radiology and Therapeutic radiology.

- Diagnostic radiology is the interpretation of images of the human body to aid in the diagnosis or prognosis of disease. It is divided into subfields by anatomic location and in some cases method.
- Chest radiology.
- Abdominal & Pelvic radiology. Sometimes together termed "Body Imaging."
- Interventional radiology uses imaging to guide therapeutic and angiographic procedures. Also known as Vascular & Interventional radiology.
- Neuroradiology is the sub-specialty in the field of brain, spine, head, and neck imaging.
- Interventional Neuroradiology uses imaging to guide therapeutic and angiographic procedures in the head, neck and spine.
- Musculoskeletal radiology is the sub-specialty in the field of bone, joint, and muscular imaging.
- Pediatric radiology.
- Mammography.

## Fluoroscopy

Fluoroscopy and angiography are special applications of X-ray imaging, in which a fluorescent screen or image intensifier tube is connected to a closed-circuit television system, which allows real-time imaging of structures in motion or augmented with a radiocontrast agent. Radiocontrast agents are administered, often swallowed or injected into the body of the patient, to delineate anatomy and functioning of the blood vessels, the genitourinary system or the gastrointestinal tract. Two radiocontrasts are presently in use. Barium (as BaSO<sub>4</sub>)

may be given orally or rectally for evaluation of the GI tract. Iodine, in multiple proprietary forms, may be given by oral, rectal, intraarterial or intravenous routes. These radiocontrast agents strongly absorb or scatter X-ray radiation, and in conjunction with the real-time imaging allows demonstration of dynamic processes, such as peristalsis in the digestive tract or blood flow in arteries and veins. Iodine contrast may also be concentrated in abnormal areas more or less than in normal tissues and make abnormalities (tumors, cysts, inflammation) more conspicuous. Additionally, in specific circumstances air can be used as a contrast agent for the gastrointestinal system and carbon dioxide can be used as a contrast agent in the venous system; in these cases, the contrast agent attenuates the X-ray radiation less than the surrounding tissues.

## CT Scanning

CT imaging uses X-rays in conjunction with computing algorithms to image the body. In CT, an X-ray generating tube opposite an X-ray detector (or detectors) in a ring shaped apparatus rotates around a patient producing a computer generated cross-sectional image (tomogram). CT is acquired in the axial plane, while coronal and sagittal images can be rendered by computer reconstruction. Radiocontrast agents are often used with CT for enhanced delineation of anatomy. Intravenous contrast can allow 3D reconstructions of arteries and veins. Although radiographs provide higher spatial resolution, CT can detect more subtle variations in attenuation of X-rays. CT exposes the patient to more ionizing radiation than a radiograph. Spiral Multi-detector CT utilizes 8, 16 or 64 detectors during continuous motion of the patient through the radiation beam to obtain much finer detail images in a shorter exam time. With computer manipulation, these images can be reconstructed into 3D images of carotid, cerebral and coronary arteries. Faster scanning times in modern equipment has been associated with increased utilization.

## Radiation Safety and Regulation

As we have seen above, that radiation and radioactive material have many beneficial applications ranging from power generation to uses in medicine, industry and research. These applications involve risk of radiation to

the people and environment. The benefits and risks of any practice involving use of radiation need to be established so that an informed judgment can be made on their use. The radiation risks to workers, public and the environment that may arise from these applications have to be assessed and, if necessary, controlled. All practices involving use of radiation must therefore be subject to standards of safety and regulatory control. Atomic Energy Regulatory Board (AERB) is the regulatory body in India to control all the practices involving use of radiation. AERB exercises control over all these practices under Atomic Energy Act 1962 and the rules issued there under. Based on the safety review of the facilities involving use of radiation, AERB issues license for the operation of these facilities and has a system of radiation surveillance during the whole life cycle of the facility. Thus all the users of radiation are required to

obtain license from AERB for the use and operation of radiation facility.

### Conclusion

While drawing immense benefits from the application of radioisotopes in medicine, care needs to be taken against the hazards associated with handling of radioisotopes. Radiation sources should be handled with care and not with fear. Risk associated in handling of radioactive material, if handled as per safety norms, is much less than the risk associated with other professions. The effectiveness of management system is enhanced by a sound safety culture that governs the attitude and behaviour of all the individuals and organizations concerned. Management and workers should be committed to radiation safety.

## CONTRACEPTION – AN UPDATE

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### Introduction:

Contraception (CONTRA + CONCEPTION) or birth control means, the deliberate use of artificial or natural methods to prevent pregnancy.

Contraception prevents pregnancy by interfering with the normal process of ovulation, fertilization or implantation. The different kinds of birth control methods act at different levels to prevent conception.

Today, contraception is of paramount importance to modern society. It has allowed woman to control and plan pregnancy, so she need not be burdened with children constantly. This enables a woman to achieve her own goals and contributes to her sense of well-being. Couples can enjoy married life without the fear of pregnancy with the use of contraceptive methods. This not only limits the family size but also provides improved quality of life.

In a global perspective, Contraception is the only answer for population explosion.

### Historical background:

The history of contraception goes back a long way. Information concerning methods of birth control can be found in the books devoted to the science of Ayurveda, a branch of the Atharva Veda and thus can be traced back to the Vedic period. One finds writings of ancient Egypt (10th century BC) which recommend spermicidal tampons made of crocodile feces. In Europe, literature mentions naturalists such as Aristate (384-322 BC) and Soranus (early second century) recommending the effective contraceptives.

### Contraceptive choices

Contraceptive choices and decisions about family size are influenced by moral, cultural, spiritual and social



**Fig.1 Contraceptive Choices**

considerations as well as by personal attitudes and experiences.

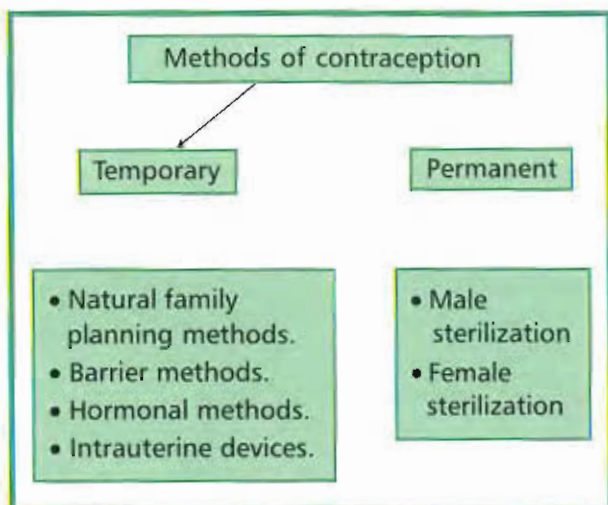
There is a wide choice of methods available, which includes:

These methods of birth control differ from each other in the timing of when they are used. Some methods of birth control must be used specifically at the time of sexual intercourse i.e. coitus-dependent (e.g. condoms, diaphragm, sponge, cervical cap, spermicides), while other methods of birth control (Depo Provera, Norplant, the IUD, and tubal sterilization) must be working all the time to provide protection even when used only once.

Emergency contraception must be started as soon as possible after intercourse and not more than 72 hours after.

Unfortunately, there is no perfect form of birth control. Only abstinence (not having sexual intercourse) can protect against unwanted pregnancy with 100% reliability. The failure rates, which mean the rates of pregnancy, for most forms of birth control are quite low. In actual practice, the birth control methods that are more difficult or inconvenient have much higher

failure rates because they are not used regularly or as prescribed.



## I. Temporary Methods

These methods are often used as spacing methods. Discontinuation of the use of these methods will result in return of fertility and hence can result in pregnancy. These methods include:

1. Natural family planning methods.
2. Barrier methods.
3. Hormonal methods.
4. Intrauterine devices

### 1. Natural family planning methods (Fertility awareness based methods)

Natural methods of family planning are those which do not use any appliances or medicines. They can be practiced most secretly by the partners and involve no cost. Although they may involve some risk of accidental pregnancy, these methods are practiced even today by educated and well motivated couples throughout the world. These methods include:

- A. Coitus interruptus (Withdrawal method).
- B. Rhythm Methods (Periodic abstinence).
- C. Lactational amenorrhoea method (use of prolonged breastfeeding to inhibit ovulation).

#### A. Coitus interruptus (Withdrawal method)

This is one of the oldest and the widely accepted method of contraception.

## B. Rhythm Method (Periodic abstinence)

This method is also known as safe period method, means restricting coitus to the infertile period of the menstrual cycle. The methods, by which the fertile period can be calculated, include:

### (i) Calendar Method

The period of abstinence is calculated from the previous 12 menstrual cycle records. The first unsafe day is calculated by subtracting 20 days from length of the shortest cycle and last unsafe day is calculated by subtracting 10 days from the longest cycle.

### (ii) Temperature Method

The temperature of the body at rest is called basal body temperature (BBT). A woman's body temperature goes up after ovulation. Ideally it should be taken each day at the same time to give the most accurate record. A special thermometer (fertility thermometer) should be used. This shows small temperature changes more easily. When recorded temperature for three days in a row is higher than all the previous six days, it may indicate that the fertile time is over. The difference will be about 0.20°C - 0.40°C (0.40°F - 0.80°F).

### (iii) Cervical Mucus Method

This method relies on the fact that the mucus produced at the cervix changes in texture and increases in amount about five days before ovulation. At first it is thick, sticky and opaque, then it becomes clearer, wetter and slippery so that sperm can travel through it more easily. This slippery wetness signals the most fertile days. Intercourse should be avoided from the first sensation or observation of mucus until four or five days after the slippery wet sensation disappears.

Methods	Pregnancy rates per 100 women years
Coitus interruptus	19
Rhythm Method	24
Lactational amenorrhoea method	2

#### C. Lactational amenorrhoea method (use of prolonged breastfeeding to inhibit ovulation)

This method is more effective when the mother breast-feeds the child exclusively for the first 6 months, including night feeds and remains amenorrhoeic.

Failure rate of natural methods of contraception in first 12 months of use.

## 2. Barrier methods

Barrier methods are contraceptives, which act as barrier and prevent the union of sperms and ovum necessary for the pregnancy.

Barrier methods are types of coitus-dependent contraception. These methods include physical barriers and chemical barriers. The physical barriers are such as the male condom, the female condom, the diaphragm, the cervical cap and the sponge. The chemical barriers are in the form of jelly, foam or films containing spermicides. Physical and chemical barriers are often used in conjunction to prevent the passage of sperm. They also provide protection from STDs.

### Male Condom:

Most condoms are made from latex rubber, while some are made from lamb intestines (sometimes called "lambskin" condoms). Condoms can also be made from a type of plastic called polyurethane. For men who are sensitive to latex, polyurethane is a good alternative. Except for abstinence, latex condoms are the most effective method for reducing the risk of infection from viruses that cause HIV and other STDs. Some condoms are prelubricated. These lubricants do not provide additional contraceptive safety or STD protection. Non-oil-based lubricants, such as water or K-Y jelly, can be used with latex or lambskin condoms, but oil-based lubricants, such as petroleum jelly (Vaseline), lotions, or massage or baby oil, should not be used because they can weaken the material.

When used with spermicides, this form of birth control also helps to prevent pregnancy by killing off the sperms.



Fig.2 Male condoms

### Female Condom:

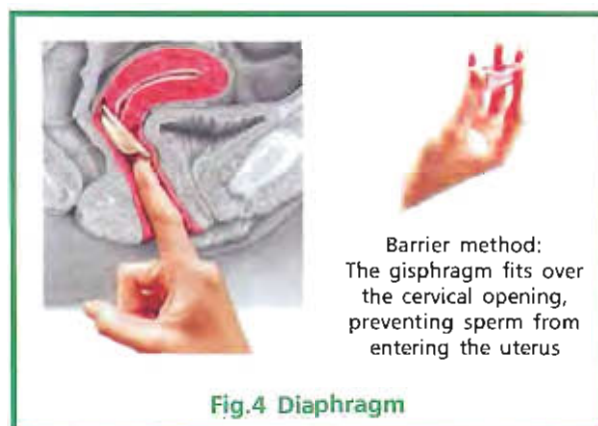
The female condom consists of a lubricated polyurethane sheath shaped similarly to the male condom. The closed end, which has a flexible ring, is inserted into the vagina, while the open end remains outside, partially covering the labia.



Fig.3 Female condoms

### Diaphragm:

It is a dome-shaped rubber disk with a flexible rim that covers the cervix so sperm cannot reach the uterus. It is available only by prescription and must be sized by a health professional to achieve a proper fit. Before inserting the diaphragm a spermicidal cream or jelly may be applied as an extra precaution. A diaphragm gives protection for six hours after its insertion. For intercourse after the six-hour period, or for repeated intercourse within this period, fresh spermicide should be placed in the vagina with the diaphragm still in place. It should be left in place for at least six hours after the last intercourse but not for longer than a total of 24 hours.



Barrier method:  
The diaphragm fits over the cervical opening, preventing sperm from entering the uterus

Fig.4 Diaphragm

because of the risk of Toxic Shock Syndrome (TSS). It can be effective when used properly, but has a higher failure rate than oral contraceptives.

### Cervical Cap:

The cap is a soft rubber cup with a round rim, sized by a health professional to fit snugly around the cervix. It is available by prescription only and, like the diaphragm, is used with spermicide. It protects for 48 hours and for multiple acts of intercourse within this time. Wearing it for more than 48 hours is not recommended because of the risk, though low, of toxic shock syndrome. Also, with prolonged use of two or more days, the cap may cause an unpleasant vaginal odour or discharge in some women. It has relatively high failure rate.



Fig.5 Cervical Cap

### Sponge:

The sponge, a donut-shaped polyurethane device containing the spermicide nonoxynol-9, is inserted into the vagina to cover the cervix. A woven polyester loop is designed to ease removal. The sponge protects for up to 24 hours and for multiple acts of intercourse within this time. It should be left in place for at least six hours after intercourse but should be removed no more than 30 hours after insertion because of the risk of toxic shock syndrome. The sponge is not the most effective birth control method and women must be aware of the failure rate before choosing the sponge as their only method of birth control.

### Advantages of barrier methods

- One of the methods of contraception for newly married couples.



Fig.6 Sponge

- Provide protection from STDs. Out of all, only condoms are recommended agents of HIV transmission prevention.
- These forms of contraception are also advantageous because they can be used intermittently and do not have systemic side effects.

### Limitations for barrier methods

- Women who have recently given birth or had an abortion having weak vaginal muscles, frequent urinary tract infections, recent cervical surgery or a history of toxic shock syndrome are not the candidates for this type of contraception.
- The contraceptive efficacy of all barrier methods depends on their consistent and correct use.

### Failure rate of barrier contraceptives in first 12 months of use

Methods	Pregnancy rates per 100 women years
Male condoms	14
Diaphragm	20
Female Condom	21
Vaginal Sponge	10

### 3. Hormonal contraception

In 1956, Pincus and his colleagues used combination of hormone like estrogens and progesterone in first contraceptive field trial in Puerto Rico. During the following years, intensive pharmacological research and



clinical trials were conducted to minimize the adverse effects of estrogens without reducing the contraceptive efficacy, resulting in lowering the dose of estrogen to a minimum of 20 micrograms, as available in present dose OCs.

Hormonal contraception is available in the form of Oral pills, injectable form, subdermal implants and Progesterone impregnated intrauterine contraceptive devices. Oral contraceptive pills are the best options available for the recently married women.

## A. Oral Contraceptive pills:

### (i) Combination (estrogen/progestin) OCs

Combination OC contains both estrogen and progestin. They are classified as *monophasic*, *biphasic*, or *triphasic*. Synthetic hormones rather than natural ones are used in OCs, because their greater potency allows for more predictable results. The two estrogens used in OCs are ethinyl estradiol and mestranol. In the body, mestranol breaks down to ethinyl estradiol.

Progestins used in OCs are synthetic progesterones. Seven different progestins are used in OC formulations. Different progestins have different strengths and side effects. They were developed to provide more choices for each woman to tolerate the OC the best.

Most combination OCs are given as active pills for 21 days followed by a 7-day hormone-free period to allow for withdrawal bleeding. Some packets of combination OCs contain only 21 pills, all of which are active. Others also include seven placebos, hormone-free pills in another color. Many users prefer the 28-day packets

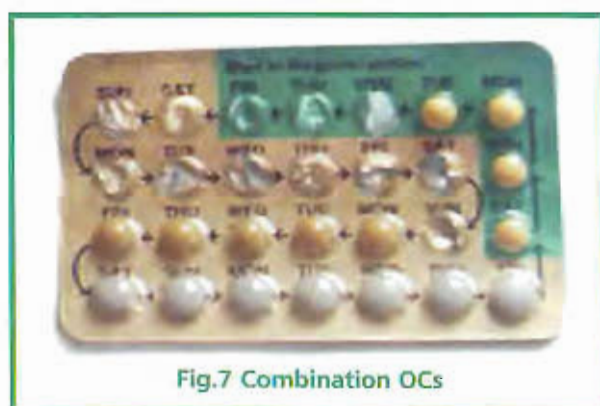


Fig.7 Combination OCs

since they do not need to make a calendar notation as to when to begin their next cycle of pills. The amount of estrogen and progestin in individual pills, of a combination OC packet may vary depending on when in the cycle the pill is taken.

- Monophasic OCs contain the same dosage of each hormone in each active pill.
- Biphasic OCs alter the progestin/estrogen ratio in 2 phases.
- Triphasic OCs alter the progestin/estrogen ratio in three multi-day phases by varying the amounts of progestin, estrogen or both.

Biphasic and triphasic OCs are thought to approximate a woman's natural hormonal fluctuations more closely by varying the progestin/estrogen ratios. The aim of these formulations is to minimize the occurrence of breakthrough bleeding and amenorrhea while maintaining efficacy. However, some physicians and patients prefer monophasic OCs because they are less confusing as all active pills are of the same colour and have the same dose of hormones.

Recently available generation of OCs with progestins containing desogestrel, gestodene and norgestimate are more lipid friendly.

### (ii) Progestin-Only OCs

Progestin-only pills (POPs), also called minipills, are indicated for women who should not take estrogen-containing pills. These include women who are breastfeeding, who are hypertensive or who are at risk for developing blood clots. Minipills are estrogen-free oral contraceptive tablets that provide a continuous flow of low dose progestin. Unlike combination OCs, progestin-only pills must be taken continuously without a hormone-free period. Minipills are slightly less effective than regular pills and often cause irregular menstrual patterns. Minipills prevent pregnancies mainly by making the cervical mucus impermeable to sperm and by making it more difficult for ovum to attach to the uterus lining.

### iii) Centchroman:

Central Drug Research Institute of Lucknow, India has produced non-steroidal compound with antiestrogenic properties. It contains 30mg of Centchroman. It is available as Centron or Saheli. It is recommended as twice a week starting from 5<sup>th</sup> day of cycle for first 3 months

## OCs and their compositions:

Commercial Names	Composition		No. of Tablets
	Progestins (mg.)	Estrogens (microgr.)	
Mala N (Govt.India)	Norgestrel 0.30	Ethinyl Estradiol 30	21 + 7 iron tablets
MalaD	D-Norgestrel 0.30	Ethinyl Estradiol 30	21 + 7 iron tablets
Loette	Levonorgestrel 0.1	Ethinyl Estradiol 20	21
Femilon	Desogestrel 0.15	Ethinyl Estradiol 20	21

and then once a week irrespective of menses. It is one of the convenient methods of contraception. The side effects are few like prolonged periods or cycles, which may occur in 10% of cases. Failure rate is 12 per hundred women years of use.

## Health Benefits of Oral Contraceptives

Only a few women appreciate the health benefits associated with the use of combined oral contraceptives. Most of the women are unaware of any health benefits, except for an improvement in menstrual pain, associated with oral contraceptive use. The oral contraceptives have protective effect in reducing the risks for uterine (81%) or ovarian (77%) cancer, ectopic pregnancy (91%), pelvic inflammatory disease (PID) (90%), and anaemia (89%). Due to the confusion and misperceptions caused, some women who would otherwise have benefited from oral contraceptives avoid using the pill. Rather than focusing on risk, clinicians should inform patients about the myriad benefits, contraceptive and noncontraceptive, associated with pill use.



Fig.8 Centchroman

## Health Benefits Owing To Contraceptive Effects

- Pregnancy Prevention and hence prevent abortions of unintended pregnancies.
- Prevent Pelvic Infections-Progestin dominance of OCs produces thick, tenacious mucous that resists penetration of bacteria and spermatozoa.
- Protection against Cancer.
- Ovarian Cancer (77%) due to suppression of ovulation.
- Endometrial Cancer (81%) Progestin domination in combined

OCs suppresses endometrial mitotic activity.

- Colorectal Cancer Estrogens in OCs reduce the bile concentration in colon and inhibit cell proliferation. Thus OCs reduce the risk of adenomatous polyps and premalignant lesions.

## Gynaecologic Noncontraceptive Benefits

- Improvement of Menstrual Problems: like Dysmenorrhoea (pain at the time of menses), Menorrhagia (Increased menstrual flow) by reduced production of  $PGF2\alpha$ .
- Correction of Iron-deficiency Anaemia by reduced endometrial proliferation and menstrual loss.
- Management of Polycystic ovarian syndrome by reducing Luteinizing hormone secretion, increasing sex hormone binding globulin, free testosterone levels are reduced.
- 50 % reduction in the incidence of uterine fibroids when OCs is used for more than 7 years.

## Other Health Benefits

- Progestin mediated protection against Benign Breast Disease.
- Bone Density improvement and prevention of osteopenia in hypoestrogenic women by estrogen replacement of OCs.

- Management of acne due to progestin effect and estrogens causing suppressing gonadotropin levels and increased levels of sex hormone binding globulins, reducing free testosterone levels.
- Menstrual Migraine due to falling levels of estrogens, can be cured with continuous OCs even in pill free period. Asthma and Porphyria which exacerbate during periods, can be improved with the treatment with OCs.
- Women with bleeding dyscrasias like von Willebrand's disease with excessive bleeding at the time of periods, can be improved with the use of OCs.

Overall failure rate of Oral contraception is 0.1 per 100 women years.

## B. Injectable Contraception

During 1960s, Upjohn developed injectable contraception. It offers users convenient, safe and reversible contraception as effective as surgical sterilization.

Commonly available Progesterone Only Injections are DMPA (Depomedroxy Progesterone Acetate) popularly known by trade name - Depo-Provera (150mg every 3 monthly) and NET-EN (norethisterone enanthate 200 mg every 2 monthly). These injections are given by intramuscular route to the women. The injections inhibit ovulation and make the cervical mucus thick and hostile



Fig.9 Injectable Contraception

to sperm, thus providing longer-term protection against pregnancy.

## Advantages of Injectable Contraception:

- Safe during lactation.
- No need to take daily dose.
- Effective for 2-3 months.
- No estrogen related side effects.
- Menstrual complaints like menorrhagia, dysmenorrhoea are reduced.
- Incidence of endometriosis, ectopic pregnancy and ovarian cancer is reduced.
- Protects against Endometrial cancer.
- Highly effective - only a 0.1 -0.6 failure rate.

## Disadvantages of Injectable Contraception:

- Route of administration is injection.
- No protection against STDs
- It affects body's natural hormonal system
- Side effects can include irregular periods, which may stop altogether, headaches and weight gain.
- Difficult to predict the time taken to get the DMPA out of the body system and to predict the time taken for the cycles to become natural and to conceive.

## C. Implantable Contraception

Implantable hormonal contraception is one of the most effective methods of contraception available. Implants work in a fashion similar to injection. It is a small plastic



Fig.10 Implantable Contraception

rod or set of rods containing hormones, that are inserted beneath the skin in females.

The initial concept of implant contraception based on Silastic polymer capsules was proposed in 1967. Norplant was endorsed by the World Health Organization (WHO) in 1985. This subdermal implant has 6 silastic rods which release levonorgestrel. Many of the innovations simplify removal, which can sometimes be painful and time-consuming with Norplant. Delivery systems now use only one or two implants rather than six because new polymers and mixtures allow controlled release of the progestin from a smaller surface area. Some implants combine carrier and progestin in a solid rod, whereas others surround the progestin with a carrier capsule. Biodegradable capsules and pellets are also under investigation. Implants with newer low-androgenic progestins may decrease side effects such as acne and mood or weight changes. Implanon (Organon) is a new single-rod implant that releases etonogestrel, the active metabolite of desogestrel, the progestin in the oral contraceptives.

#### Advantages:

- Last for up to 5 years
- Highly effective, failure rate being 0.1 per 100 women years.
- Important option for women who have problems with coitus-dependent or memory-dependent methods or intrauterine devices (IUDs).
- Implants can be used in breast-feeding women and older women with cardiovascular risk factors, a history of thrombophlebitis or pulmonary embolism.
- Implants have the potential to decrease menstrual blood loss, anaemia, the risk for genital tract infection and pain associated with endometriosis.
- Immediate return of fertility after removal of implant.

#### Disadvantages:

- The surgical procedure is required for insertion and removal of implant.
- Removal can be difficult if the capsules are inserted too deeply and may require more than one visit.

- Menstrual disruption is the most common side effect and leads to many early discontinuations.

## 4. Intrauterine Devices (IUDs)

These are small flexible devices made of metal and/or plastic that prevent pregnancy when inserted into a woman's uterus through her vagina. In ancient times, Arabs and Turks used to insert pebbles in the uteri of camels to protect them from pregnancy during long journeys through deserts. Intrauterine device as a method of contraception for women was first introduced by a German physician, Richter, in 1909. IUDs are safe and effective methods of reversible, long-term contraception for most women. They do not affect breastfeeding, interfere with intercourse or have hormonal side effects. Their popularity stems from their effectiveness combined with their long duration. The most widely used IUDs are copper-bearing IUDs like CU T 200B, CU T.380A, Multiload 250, Multiload 375 and progestin-releasing IUDs (levonorgestrel) like LNG-IUS-Mirena.



Fig. 11 Intrauterine device (IUD)

#### Characteristics of IUDs Mode of action

It is through a combination of mechanisms: inhibiting sperm migration in the upper female genital tract, inhibiting ovum transport and stimulating endometrial changes.

#### Time of insertion

- Postmenstrual preferably inserted within 2-3 days after the period is over.

- Immediately after induced early pregnancy termination.
- 6 weeks after spontaneous abortion or normal or caesarian delivery.

### Duration of use

- The Copper T 380A device remains effective for up to 10 years.
- The Multi-load copper IUD remains effective for up to five years.
- The levonorgestrel-releasing IUD Mirena is effective for at least five years.
- Most women who are satisfied with the method can use IUDs safely throughout their reproductive years.

Return to fertility is immediately after removal.

Effectiveness 0.4% to 2.5% failure rate for copper IUDs and 0.1% failure rate for the levonorgestrel-IUD during the first year of typical use.

### IUDs and Pelvic Inflammatory Disease

The most definitive review of IUD safety, particularly regarding PID, is the World Health Organization review of 12 studies involving nearly 23,000 IUD users around the world. The study found that, overall, the rate of PID among IUD users was very low.

### Advantages of IUD

- Requires one time motivation.
- It does not interfere with the sexual act.
- No systemic side effects
- Fertility returns to normal immediately after removal.

### Limitations of IUD

- Some women (10%) may complain of intermittent bleeding, vaginal discharge or pain during periods, which need medication.
- Rarely expulsion may lead to failure and pregnancy.

### New Generation of IUDs

The newest generation of copper IUDs combine high continuation rates with very low pregnancy rates. Recent research has focused on developing devices to address side effects, particularly bleeding and pain, which account for a significant number of removals.

### Mirena (LNG- IUS)

Mirena, the levonorgestrel-releasing IUD, with high effectiveness and acceptability, reduces menstrual blood loss as compared to pre-insertion levels. It is advisable as a method of contraception in premenopausal age group especially if the woman has a history of excessive bleeding due to benign cause.



Fig.12 Mirena (LNG- IUS)

### Gynefix (Frameless IUD)

The Frameless IUDs, such as Gynefix have been specifically designed to reduce cramping and pain. This device consists of a surgical nylon thread that holds copper sleeves and is anchored to the uterine fundus during insertion. Studies suggest that the Gynefix is as effective as the Copper T380A and expulsion rates are less than 1 per 100 women years.



Fig.13 Gynefix (Frameless IUD)

### Emergency contraception methods and failure rates

Drug	Dose	Pregnancy Rates %
Ethinyl Estradiol	2.5 mg BD x 5 days	0-0.6
Conjugated estrogen	15 mg BD x 5days	0-0.6
Ethinyl Estradiol 50mcg + Norgestrel 0.25mcg (Ovral)	2 tabs stat & 2 after 12 hours (Yuzpe method)	0-2
Levonorgestrel	0.75 mg stat & after 12 hours	0-1
Mifepristone (RU486)	600mg single dose	0-1.6
Copper-IUD	Insertion within 5 days	0-0.1

## Emergency Contraception

Pregnancies may result from contraceptive failure or inadequate contraceptive technique. Sometimes they may occur owing to a failure to use any type of contraception, because of unanticipated and thus unprotected sexual activity or as a result of sexual assault. Although not all unintended pregnancies are unwanted, emergency contraception is generally used when pregnancy is not desired.

The American College of Obstetricians and Gynaecologists has defined emergency contraception as "a therapy for women who experience an act of unprotected sexual intercourse." It has been also described as 'postcoital contraception' or 'the morning after pill.' The procedure is most appropriately described as emergency contraception because there are methods besides pills.

### The methods of emergency contraception

These include:

- Combination oral contraception pills
- Progestin-only pills
- Antiprogestins and
- The copper IUD.

### Timing for emergency contraception

- The pills can be taken up to 72 hours after exposure.

- An intrauterine device (IUD) can be placed up to 5 days from exposure.

Some woman experience nausea, vomiting, irregular uterine bleeding and other side effects like headache, fatigue, and breast tenderness.

No fetal side effect has been observed when there is failure of emergency contraception. However, induced abortion is offered to the patient if the method fails. This method of contraception should be reserved only as emergency and not to be practiced as a routine method of contraception.

## II. Permanent Methods

Permanent surgical contraception is called voluntary sterilization. For the couple desiring no more children, permanent sterilization of one of the partners is the most effective and the best method of contraception. Couple must be counseled adequately before any permanent procedure is undertaken as this is an irreversible method of contraception. This includes methods like male and female sterilization.

### A. Male sterilization (Vasectomy)

In this procedure the segment of vas deference of both the sides are resected and cut ends are ligated. Dr. Li Shungiang in Sichuan province introduced 'no scalpel vasectomy' (NSV) in 1974 in China. It has replaced conventional vasectomy in many countries since 1986.

## B. Female sterilization (Tubectomy)

It is an operation where segment of both fallopian tubes are ligated and blocked with or without resection, so that ovum released by ovaries cannot get fertilized by the sperms. Dr. J. Blundell of Landon performed the first tubectomy in 1823.

Tubectomy can be performed by trans- abdominal or trans- vaginal approach. Trans-abdominal is the simple and safe approach.

### Tubectomy by abdominal approach includes:

- Laparotomy—as at the time of Caesarian section etc.
- Minilaparotomy- after mid trimester medical termination of pregnancy
- Laparoscopic Tubal sterilization

### Timing for tubectomy

This procedure can be performed:

- During puerperium- within 6 weeks of delivery
- Interval- Following menstrual period
- Post abortal- Following first or second trimester medical termination of pregnancy

### Ligation Methods

Open tubectomy (laparotomy/ minilaparotomy) can be performed by various different surgical methods like Pomeroy method, Parkland method, Uchida method and Irving method.

Puerperal sterilization and post mid trimester abortion, tubectomies are performed by open method.

Laparoscopic sterilization is performed by introducing endoscope via the small incision taken just below the umbilicus after producing pneumoperitoneum. The fallopian tubes are occluded by silastic rings. Endothermal coagulation of tubes is not practiced due to high failure rate. Laparoscopic sterilizations are performed after first

trimester medical termination of pregnancy or as interval method.

### Type of anaesthesia

Regional anaesthesia is given for minilaparotomy tubectomy procedures, while laparoscopic sterilization is done under general anaesthesia or under intravenous sedation and local infiltration.

**Overall Failure rate** of tubectomy is 0.7 %

In developing countries like India, tubectomy remains the mainstay of the National Family planning programme. It is safe and widely acceptable. Laparoscopic sterilization offers a promising success.

### Newer Contraceptive Methods

Many other methods of contraception are under research or available in other countries.

These include hysteroscopic insertion of 'microcoil essure' to block the fallopian tubes. Due to high cost and complexity of hysteroscopic instrumentation this method is not yet freely available in developing countries. In male methods many hormonal methods like testosterone enanthate, Depot medroxy progesterone acetate, cyproterone acetate etc. are under trials.

Non-hormonal methods under trial include herbal preparations like gossypol, Tripterygium Wilfordil. Indian Institute of Technology and All India Institute of Medical Sciences have developed RISUG (reverse inhibition of sperms under guidance). This polymer when injected in the vas can occlude the vas. Intra vas device is under research. Researchers are also concentrating in developing vaccine like anti-HCG, antizona and antisperm vaccines.

Thus, many more contraceptive methods are under research on the horizon. After reviewing the present available methods, a wise step towards birth control now, can create health and happiness in the future.

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*No woman can call herself free,  
Until she can choose consciously whether  
She will or will not be a mother.*

— *Margaret Sanger (1879-1933)*  
*An American Birth Control Activist*  
*The founder of American Birth Control League*



## NON-SCALPEL VASECTOMY

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### Introduction

Traditionally, in our society, women are expected to be responsible for family welfare. It is partly because women have to bear a disproportionate burden of the health and economic consequences of childbearing and rearing, and partly because research organizations and family planning organizations have focused upon female methods of contraception. As a result, women have many contraceptive choices, ranging from oral pills and intrauterine devices to tubal ligation.

In the current era, there are only two forms of male contraception available - condoms and vasectomy. Condoms have virtually no side effects and are effective means of preventing sexually transmitted diseases, but as a contraceptive device, they have only marginal efficacy. UN reports that only 5% of reproductive age women worldwide, rely on condoms for contraception. A significant drawback of condoms is their poor long term compliance, with more than half the users are reported to have either improper or inconsistent use. Many men also dislike condoms as they feel condoms diminish sexual pleasure. Even if the condoms are used correctly, the condom breakage and slippage is not infrequent, occurring in upto 2 to 8% cases.

Vasectomy is a simple, safe and highly effective outpatient surgery with failure rate of less than 1% and a very low incidence of complications. Presently, at BARC Hospital, we are offering the state-of-the-art "non-scalpel vasectomy" (NSV) and in the last one year 25 cases of NSV have been performed. The technique is simple, safe and effective.

Regarding NSV, the main question however, is its acceptability. Unless a method is reliable and acceptable to both men and their female partners, one cannot call it true advancement in the field.

Acceptability of male contraception is influenced by the economic, cultural, educational, religious and relationship status. It is encouraging to note, that 98% of women in stable relationships would be willing to rely on their male partner. Also, majority of men feel that the responsibility of contraception is too much on women and are receptive to the male based methods, and would be happy using a male hormonal contraception if available. But the fact remains that the acceptability to vasectomy is low even in educated class and majority of men have misconceptions and fixed notions about vasectomy. The idea of this article is to explain the technique and put it in the right perspective.

### Anatomy of sperm conduction pathways:

Sperms are produced by the testes and travel through a pair of sperm tubes called vas deferens. The vas carry the sperms from the testicles to the seminal vesicles which store these sperms and produce the seminal fluid which makes the bulk of the ejaculate (Fig.1).

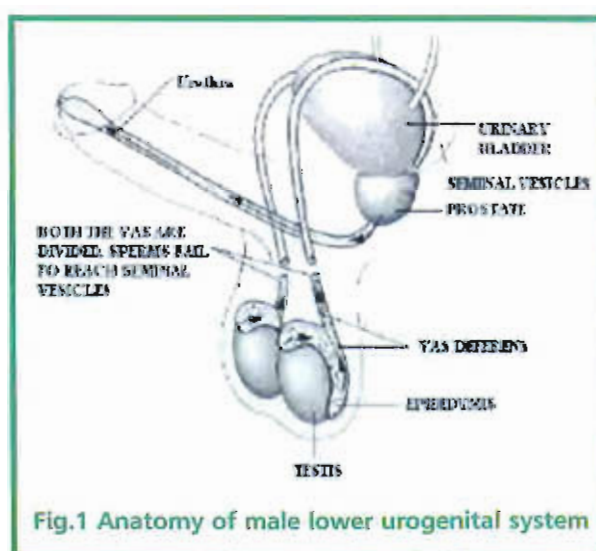


Fig.1 Anatomy of male lower urogenital system

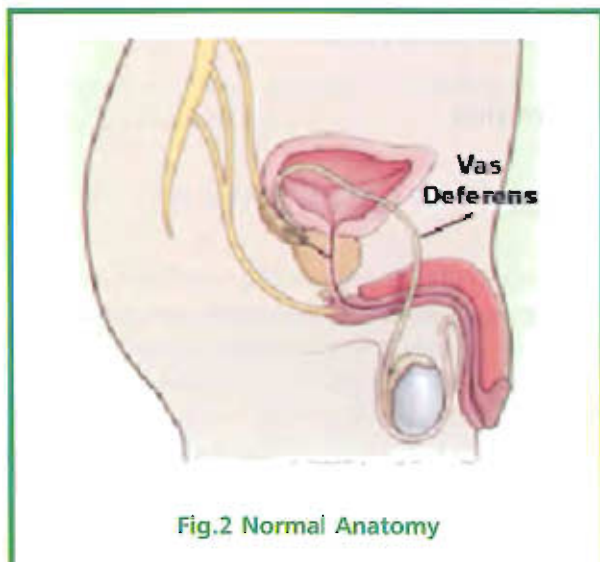


Fig.2 Normal Anatomy

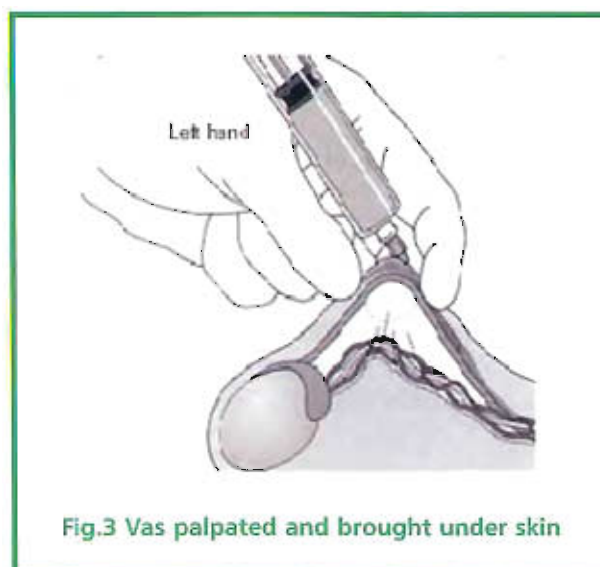


Fig.3 Vas palpated and brought under skin

*The NSV procedure interrupts the flow of sperm to the seminal vesicles. The testes still produce sperm, but they are simply broken down by macrophages into their basic molecules like other body cells.*

### Procedure:

Non-scalpel vasectomy is an OPD procedure, done under local anaesthesia. The surgeon palpates the vas deferens tube under the skin of the scrotum and holds it in place. Local anaesthesia is infiltrated in the skin and along the vas (Fig.3). Using a vas dissector, a small puncture is made in the skin just overlying the vas. The hole is stretched and vas is pulled using the vas dissector and a ring forceps (Fig.4). It is then divided, the cut ends are tied and released back in scrotum. The same procedure is repeated to the other vas. The tiny skin puncture does not require any closure and heals within a few days almost without a trace. The net result is no incision, minimal dissection and no skin sutures.

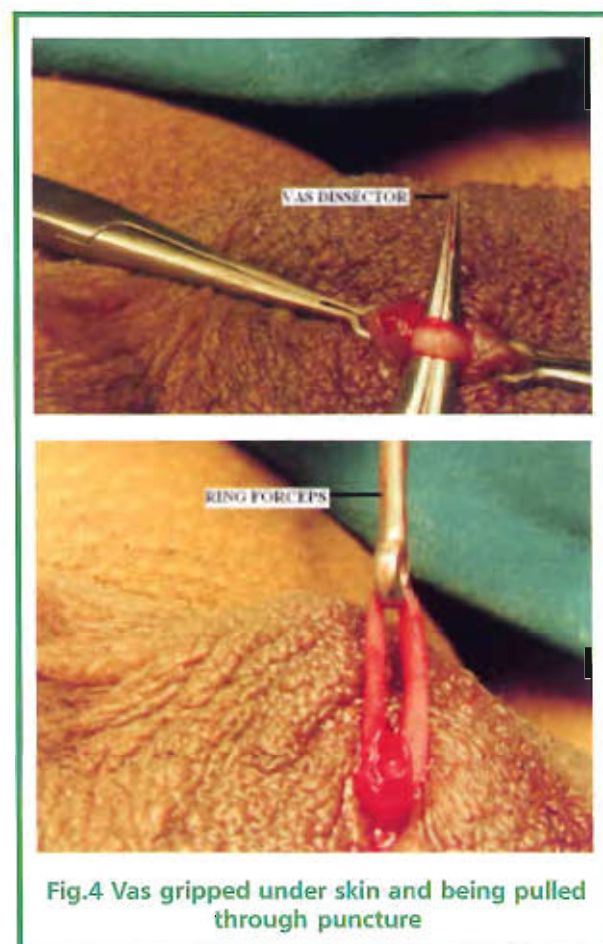


Fig.4 Vas gripped under skin and being pulled through puncture

### Post procedure:

There is some discomfort for a couple of days and scrotal support and light work is recommended for a

week. Sexual intercourse can be resumed after a week but one should continue to use the prior method of birth control till the sperms already stored in the seminal vesicles are flushed out. It generally takes about 30 ejaculations and semen analysis is done 3 months after the surgery. By this time 95% of men are sterile. If the test reports "no dead or motile sperm seen", the surgeon gives the certificate of 'completion of vasectomy' and one is allowed to discontinue the prior method of birth control. If the test shows "non motile" or "dead sperms", then follow-up test is done twice after a gap of one week each. If these follow-up tests again shows "dead sperm", one can still discontinue the other methods of birth control. The studies show that there is no increased risk of pregnancy with 3 consecutive readings of "dead sperm" when compared to readings of "no sperm". However, if any of the follow-ups tests show "moving sperm", then one requires a repeat test at 6 months after vasectomy. If this moving sperm does not clear up, the vasectomy is declared a failure and it should be redone.

### Complications:

Long term safety with vasectomy is excellent. However the following complications are possible.

#### 1. Hematomas

- Mild bleed in the area of dissection may occur in 10% of procedures. This gives some discomfort but usually subsides in one to two weeks.

#### 2. Epididymitis

- Presents as a tender swelling in the epididymis (the structure lying at the back of the testis continuing further as vas. Refer Fig.1)
- It also subsides with antibiotics and scrotal support.

#### 3. Sperm granuloma

- At the site of vas interruption a small tender nodule may occur, usually due to extravasated sperms at the end of the cut end of the vas.

The reason why they are formed is not well understood.

- Steroid injection into the granuloma has been found to be effective.

#### 4. Post vasectomy pain syndrome

- It is a well recognized and a rare complication of a persistent dull ache in the testis, occurring in 5% of cases.
- This syndrome may begin immediately after the vasectomy or many months or even years after the vasectomy.
- The etiology is not clear and hypotheses have been proposed regarding nerve irritation, epididymal congestion depression, somatization and immune mechanisms causing an inflammatory response.

#### 5. Vasectomy failure (recanalization)

- Once the vas are cut and the ends ligated, the chance of tubal recanalization is extremely small, but possible.
- The incidence of vasectomy failure is estimated around 0.5%.

### Acceptability, myths and facts:

Men are often reluctant to consider vasectomy because of inaccurate information and myths. Majority of men have the following misconceptions.

1. Loss of libido and poor erection.
2. Scanty ejaculate and lack of sexual pleasure.
3. Lack of testosterone causing easy fatigue and loss of energy.
4. Freedom from acquiring sexually transmitted disease.

After vasectomy, a man is essentially the same except for his blocked sperm tubes. The male hormone is carried in blood has nothing to do with the sperm tubes. Regarding the volume of ejaculate, it is just the same. The ejaculate is normally formed by secretions from the seminal vesicles; the prostate and sperms contribute to only 1% of the ejaculate. Further, vasectomy does not affect the sex drive. Rather

vasectomy liberates a man to enjoy sex. Most men report that after vasectomy sex becomes better, more relaxed and spontaneous as there is peace of mind and security after a permanent contraception. A vasectomy is also a positive thing in a relationship because the female partner also benefits. No more pills and worries. However, having a vasectomy is not going to give a licence to have unprotected sex in casual relationships. After vasectomy, one is equally vulnerable to sexually transmitted diseases without barrier contraception.

### Vasectomy reversal:

The major drawback of vasectomy is lack of complete reversibility. Vasectomy reversal (vasovasostomy) involves microscopic anastomosis of freshened ends of the divided vas. It has the potential to restore fertility, however, the pregnancy rates are only 30-60%. Infact, 20-40% of couples remain infertile after vasectomy reversal, despite restored patency of vas (as documented by imaging techniques). Chances of pregnancy after reversal surgery are best in the first year post vasectomy and drops 10% further every year thereafter. This is due to formation of anti-sperm antibodies due to which even if the anatomical patency is reestablished, fertility rate is poor.

### Vasectomy versus tubal ligation:

A vasectomy is faster, cheaper and a simpler surgery as compared to a tubal ligation and therefore carries a lesser operative risk.

### Vasectomy is a lifetime decision:

As the restoration of fertility is uncertain after vasectomy reversal surgery, it should be regarded as permanent sterilization rather than contraception. Therefore, vasectomy is a lifetime decision. One should consider the possibility of unforeseen changes in life - divorce, death of a spouse or child, or the likelihood of the couple changing mind about the desired family size. If one has decided that no matter what the future brings, he will not like to have any more children, then non- scalpel vasectomy is a very reasonable consideration. But if one is not sure, he should wait

and use other methods of birth control till the issues are resolved.

About 10% of men change their minds at a later date and look for reversal procedure. Since the decision to have a vasectomy affects both spouses, it should ideally be a joint decision. Statistically, men who regret a vasectomy least are those where both the husband and wife attend the counseling session, and the decision is well thought over. On the other hand, those who are under pressure or take a hasty decision, often regret the decision.

Sperm freezing (banking) is also an option to vasectomy reversal, but this is expensive to store and use (by IVF), and the sperm quality deteriorates over time. Moreover most of the vasectomy candidates do never use their stored sperms and keep on paying exorbitant price for so called 'a peace of mind'.

### Summary:

Non-scalpel vasectomy is highly effective, simple and safe. It does not affect overall male health and sexuality. As it is not surely reversible and it is most appropriate for men who are sure that they will not have any more children under any circumstances.

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*It is a man's 'turn' to take responsibility for family welfare*

## “DONATE BLOOD SAVE LIFE”

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Blood transfusion is an essential part of modern healthcare. Blood is a living matter, which can be transfused to save lives. Good nutrition, a clear and healthy lifestyle, proper prevention and early detection / treatment of disease, all contribute to healthy blood in the system. Healthy blood can and does save lives.

### Some facts about Blood

- 40-45% of blood is made up of red blood cells which carry oxygen. Remaining 55-60% is plasma with a small portion of white blood cells, clotting factors and platelets. Each component plays an important role in saving lives.
- The average volume of blood in an adult is 4.5-5.5 litres or about 8% of the body weight.
- Blood contains 4-5 million red blood cells per mm<sup>3</sup>, 4,000 - 11,000 white blood cells per mm<sup>3</sup> and 1.5 to 4 lacs platelets per mm<sup>3</sup>.
- Red blood cells live for about 120 days and white blood cells normally last for 3-9 days.
- New blood cells are constantly generated in the body.
- Every time a person's heart beats, 20% of heart's output goes directly to brain carrying oxygen which is vital for survival.
- Every capillary, vein and artery in a person's body if lined up end to end, would cover a distance of 150,000 kilometers.
- Blood can safely be donated by a healthy person, three or four times a year.
- After each withdrawal of blood, it takes 36 to 48 hours for body to reconstitute the fluid volume and 21 days for blood cell count to return to a normal level.
- Substitutes for blood are crystalloids and colloids, which are used to restore blood volume when there are enough red blood cells circulating, but not enough fluid [plasma]. Crystalloids are sterile salt solutions and colloids are sterile complex sugar solutions, which can remain longer in circulation.

### Blood Products:

- Cellular components: Red cells  
Platelets  
Granulocytes  
Lymphocytes
- Plasma components: Fresh Frozen Plasma  
Cryoprecipitate
- Plasma Derivatives:  
Albumin  
Immunoglobulin (i.m / i.v)  
Coagulation factor concentrates

### Mandatory Screening Tests

- HIV 1 and 2
- HbsAg
- HCV
- VDRL
- Malarial Parasite

### Indications of Blood Transfusion

- Surgery
- Accidents
- Child Birth
- Burns

5. Bleeding Disorders
6. Blood Cancer
7. Anaemia
8. Sudden Blood loss due to haemorrhages

### Condition for donation

1. Any healthy person between 18 to 60 yrs. of age can donate blood.
2. Donor's weight should be 45 kg or more and haemoglobin should not be less than 12.5 gm/dl.
3. Blood pressure of donor should be systolic between 100 and 150/ mmHg and diastolic between 60 to 100/mmHg
4. Donation interval between two donations should be 3 months.
5. Donor should not be suffering from any disease and should not be on regular medication.

### Method of Donor Recruitment

1. Donor deserves to be treated courteously with interest shown for clarification of any doubt, he or she may have on blood donation.
2. The flight crew of aircraft, construction workers on high buildings and scaffolding, railway and truck drivers should not be accepted as donors, if they have to return to work within 24 hours of donation.
3. Donation should not be accepted immediately after a heavy meal to avoid lipemic plasma.
4. Proper and complete medical history should be taken for the protection of both, the donor and the recipient.
5. Physical examination should be brief and the following parameters should be within acceptable values.
  - General appearance
  - Weight
  - Haemoglobin concentration
  - Temperature

- Pulse
- Blood Pressure

### Post Donation Instruction

1. Drink more fluids than usual in the next four hours.
2. Do not smoke for half an hour.
3. Do not take Alcohol until you have eaten.
4. Normal activities can be resumed after half an hour.
5. Remove bandage after few hours.
6. If there is dizziness, one has to, either lie down or sit down with head between the knees.
7. Do not leave blood bank area until released by the personnel in the blood bank.
8. If there is bleeding from phlebotomy site, raise arm and apply pressure.

### BARC Blood Bank

BARC blood bank is a well equipped licensed blood bank having facilities like routine and emergency blood grouping, cross-matching services, screening for transfusion transmitted diseases and detection of anti body titers. There are facilities for bleeding of healthy donors, storage and issuing of whole blood to the needy patients as per stringent protocols of Food and Drug Administration, the blood bank is licensed by Maharashtra FDA and is a member of the Federation of Bombay Blood Banks.

Providing safe blood to the patients is the main aim of blood bank at BARC Hospital. Hence blood is collected only from healthy donors as per established donor criteria. Strict screening of donors is carried out to exclude professional donors, thus guaranteeing safety. All units of blood are screened for HIV antibodies, HbsAG, HCV antibodies, VDRL test and Malarial Parasites. The blood bank has trained staff including experienced doctors.

Pretransfusion testing is done for every transfusion to check for compatibility by stringent techniques and only compatible units of blood are issued for transfusion. All the activities in the blood bank are strictly recorded

**Myths about Donation**

1. Needles used may not be sterile and the donor may contract infection like HIV and Hepatitis etc.
2. Quantity of blood collected may be more.
3. Donating blood may make the donor weak and anaemic.

**Rectification**

Nowadays for blood collection, sterile blood bags are used which have a sterile needle attached. These bags can be used only once, hence the needle also cannot be reused.

Blood bags used for collection, have affixed capacity, hence excess of blood cannot be collected.

Before donation the blood donor undergoes a medical checkup, which ensures that the blood donor is fit and has a normal Hb level. Any donor with a normal Hb level will compensate for the blood donated in 3-4 weeks and fluid volume to get replaced within 36-48 hrs.

including donor identification, recipient identification, stock register, cross-matching and grouping record. Strict policies and procedures are implemented as per Standard Operating Procedures, to maintain quality and efficacy resulting in negligible numbers of transfusion related adverse effects.

**Future Plans**

Our future plans include separation of components from whole blood to facilitate treatment of different patients with requirements of components such as red blood

cells, platelets or liquid plasma. The goal is to maintain the viability and function and to prevent detrimental changes and assurance of adequate blood supply.

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*"We make a living by what we get, but we make a life by what we give."*

-Sir Winston Leonard Spencer-Churchill (1874-1965)

## PAIN MANAGEMENT

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Relief from pain is every patient's right and is usually taken care of, by the treating doctor. Intra and post-operative pain relief is managed by the anaesthetist. Pain could be due to various reasons and often needs a multimodal approach.

### Classification of Pain

Most often, pain is classified as being either acute or chronic.

#### Acute pain

Begins suddenly and gets resolved quickly although by definition, it may last for 3 to 6 months. It is important to control acute pain to prevent it from becoming chronic.

#### Causes of acute pain include:

- Broken bones
- Burns or cuts
- Certain diseases
- Dental work
- Labor and childbirth
- Soft tissue injury
- Surgical pain (post-operative pain).

#### Chronic pain

Pain persisting for more than 6 months.

#### Causes of chronic pain:

- Myofascial pain - is caused by painful trigger points that develop in a muscle or a group of muscles. This pain is described as nagging, burning, aching or stabbing.

- Radicular pain, or radiculitis, is caused by inflammation of a spinal nerve root which can be cervical (neck) or lumbar (low back). Sciatica is a common term used to describe pain that descends into the leg. Different disorders can cause spinal nerve compression and inflammation resulting in pain, like
  - A Disc herniation
  - Spinal stenosis
  - Osteoarthritis of facet joints.

They all can cause radiculitis and if not treated early may progress to radiculopathy which is difficult to treat.

- Somatic pain is caused by bodily injury or other events affecting the pain receptors in the skin, ligaments, muscles, bones or joints. This pain may be chronic and is sometimes associated with cancer.
- Visceral pain is caused by internal organs that are damaged or injured. Chronic pain management is difficult and time consuming. A multidisciplinary approach, involving several specialists who offer treatment separately or simultaneously, has become a standard of care.

Patients with chronic pain usually shuffle between primary care physicians, specialists, and therapists of all kinds in search of a solution to their pain problems.

According to the American Society of Interventional Pain Physicians (ASIPP), Interventional pain management is a discipline of medicine devoted to the diagnosis and treatment of pain and uses some special procedures, injections and minimally invasive techniques to give relief from chronic pain.

Interventional Pain Management can be a useful alternative for patients who have exhausted other treatment methods without success and may be the solution, chronic pain sufferers are looking for. It will help them to improve their quality of life by



- Reducing the duration and severity of pain
- Allowing increase in activities at home and at work
- Learning new skills for coping with pain
- Ending sleep problems due to pain
- Reducing the intake of pain killers.

Members involved in treating chronic pain are the

- Anesthesiologist
- Orthopaedician
- Physical therapist
- Psychologist
- Psychiatrists

The most important member of the team is the patient whose full co-operation is required for a successful outcome to be achieved.

### Interventional pain services at BARC Hospital

Pain Clinic in the hospital was started a year back. It is managed by the Anaesthetists and two visiting Pain specialists. The patients are referred to us by the orthopedician, surgeon and sometimes the physiotherapist.

The incidence of Chronic Back pain and shoulder pain was found to be high in our patients which prompted us to initiate this service.

### Back pain

Our lower back is the hinge between the upper and lower body, and is especially vulnerable to strain and injury when we are lifting, reaching and twisting. Most of us have experienced back pain at one time or another. However, when the pain is persistent and recurring regularly, there is need to seek professional help.

### Symptoms

- The pain may radiate down, the front, side or back of the leg or it may be confined to low back.
- The pain may become worse with activity.
- Occasionally the pain may be worse at night or with prolonged sitting such as on a long car trip.

- There can be numbness or weakness in the part of the leg that receives its nerve supply from a compressed nerve.

Treatment can be either surgical or non-surgical, depending on the condition.

### Non-surgical Treatment includes Medication

Many patients benefit from medication, which relieves low back pain by reducing inflammation or muscle spasms.

### Physiotherapy

It has a very important role and helps in strengthening the muscles of the back.

### Interventional therapy

This can be given when the patient does not get relief with medication and physiotherapy.

### Types of Interventional therapies

#### • Epidural Steroid injections (ESI)

Epidural steroid injections are used to treat conditions like herniated discs, protruding discs, degenerated discs, osteoarthritis of the spine, spinal stenosis and scar tissue or other changes following surgery. These injections can be given in any segment of the spine like lumbar, cervical, caudal etc.

The first epidural injection using the caudal approach was performed in 1901, when cocaine was injected to treat lumbago and sciatica. Between 1920s-1940s large volumes of normal saline and local anaesthetics were injected. Corticosteroids into the epidural space for the management of lumbar radicular pain were first used in 1952.

The response to steroid injection will depend on certain factors like

- Patients with symptoms of shorter duration have more sustained relief.
- Patients in chronic pain get better relief when injected during an acute exacerbation.

- Patients younger than 60 years, non-smokers and those who have not had previous back surgery respond better.
- Patients response also depends on the underlying patho-physiology. Radicular pain from disc herniation responds more favourably than from spinal stenosis.

#### • Nerve root and medial branch blocks

Local anaesthetist injections are given to determine if a specific spinal nerve root or the joint is the source of pain by blocking the nerve temporarily and seeing if the patient gets relief. Once proved, steroids can be injected to reduce inflammation and pain.

#### • Pulsed Radio-Frequency Neurotomy (PRFN)

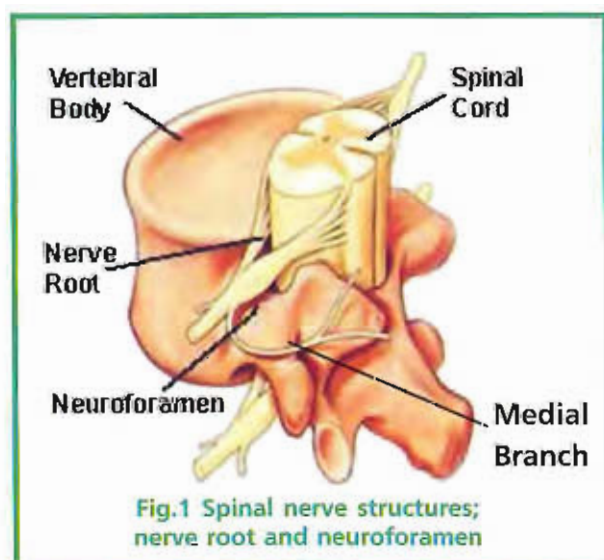
A minimally invasive procedure that disables spinal nerves and prevents them from transmitting pain signals to the brain. This is done after a temporary block has proved to be the source of pain.

#### • Facet joint injections

Local anaesthetic injection is given in the facet joints to determine if they are the source of pain. If so, further treatment can be given to provide permanent pain relief.

#### • Discography

An "inside" look into the discs to determine if they are the source of pain by injecting a dye into a disc and



then visualising it using X-ray or CT Scan. If the disc is the source of pain, tissue is removed from the disc to decompress and relieve pressure by doing a Percutaneous Discectomy or Nucleoplasty.

#### • Rhizotomy

A procedure in which pain signals are "turned off" through the use of heated electrodes that are applied to specific nerves that carry pain signals to the brain.

#### • Spinal cord stimulation

Electrodes are implanted in the cord. They give out electrical impulses which block the perception of pain in the brain.

#### • Intrathecal pumps

A surgically implanted pump that delivers pain medications to the precise location in the spine where the pain is located.

#### • Shoulder Pain

Many people suffer from chronic pain around the shoulder with restriction in the movement. This is usually a Myofascial pain and can be treated with analgesics, physiotherapy and trigger point injections.

Sometimes this pain is due to entrapment of the nerve (Suprascapular nerve) which innervates the muscles around the shoulder. A nerve block with a local anaesthetic and steroid helps in reducing the pain and swelling, thus reducing the pressure over the nerve. The pain relief thus helps the patient to do better exercises. Lifestyle modification (such as exercise, diet, and smoking cessation) helps to further enhance the effect of the above treatment.

The usual anxiety patients have is the use of Steroids.

#### What are corticosteroids and how do they work?

Corticosteroids are a group of related compounds that are naturally occurring in the body as well as synthetically produced. Corticosteroids act to regulate salt and water balance as well as decrease inflammation. They are used in the treatment of pain and disease, primarily for their anti-inflammatory effects. The anti-inflammatory action helps to reduce pain by blocking inflammatory

chemicals that sensitize nerves and nerve receptors. They should not be confused with anabolic steroids that athletes use to build muscle mass. Analgesic effects of corticosteroids most likely are related to the following mechanisms:

- Inhibition of PLA2 and inflammation
- Inhibition of neural transmission in nociceptive C fibers
- Reduction of capillary permeability

### What are the possible side effects of injected Corticosteroids?

Injectable fat soluble preparations of corticosteroids have much fewer side effects than oral or intravenously administered corticosteroids. The effects are usually dose related and will occur most frequently in patients who use these medications systemically over long period of time. By giving a steroid injection at the disease site, a high concentration of the drug is deposited at the actual site of inflammation.

### Chronic Somatic pain

Usually occurs due to cancer and can be treated by Radiofrequency ablation or chemical Neurolysis of the nerves which carry the pain to the brain. This gives relief for a longer duration and on recurrence of the pain, the procedure can be repeated.

Although there are certain side effects of the injection itself, these are uncommon and easily treated. They include

- Infection
- Bleeding
- Prolonged nerve block
- Nerve damage
- Allergic reaction
- Should the injection inadvertently gain access to an artery, it is possible to experience a brief seizure-like disorder which is self limited and treatable.

On the first appointment at the Pain Clinic, a thorough physical examination is done and a medical and surgical history is taken. All the past

x-rays or test results related to the pain condition are seen. Patients condition is discussed, regarding where the pain is located, the severity, when it occurs and if you are experiencing other symptoms related to your pain.

It is also very important for the patient to inform the doctor about other treatments they have tried, including medications and alternative therapies like acupuncture, herbal remedies or massage.

Once the treatment plan is made the patient is explained the procedure and an appointment given.

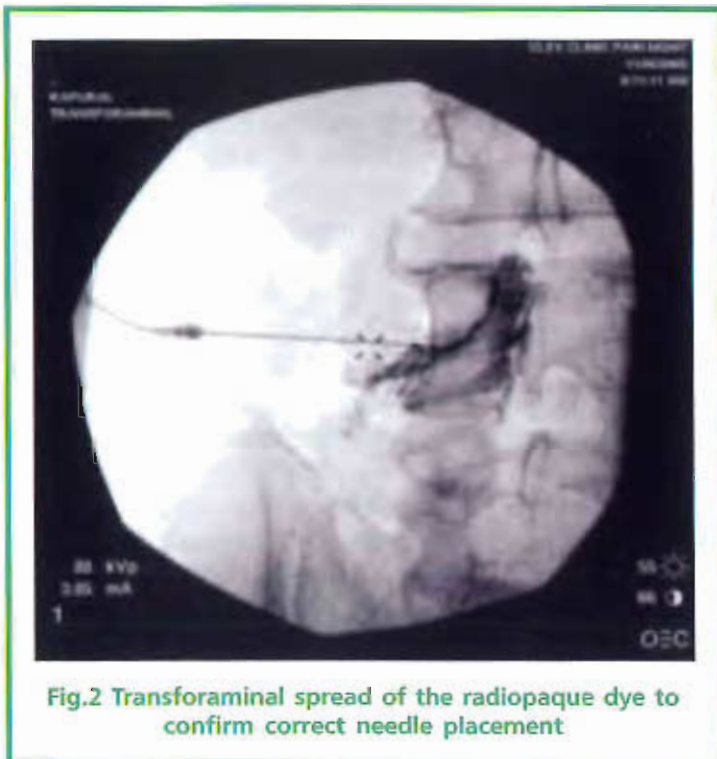
On the day of the procedure the patient is called after having breakfast at home and admitted to the ward for changing into hospital clothes. They are called to the Operation Theatre on availability of the O.T. In the theatre an Intravenous catheter is put and monitoring is done. Usually all patients receive a single dose of antibiotic to avoid any infection, after giving a test dose.

In our hospital, all these procedures are done in the Operation Theatre with all aseptic precautions. The procedure is performed with the patient lying on their belly using fluoroscopic (real-time x-ray) guidance, which helps to prevent damage to the nerve root. A radiopaque dye is injected to enhance the fluoroscopic images and to confirm that the needle is properly placed (See Fig. 2). This technique allows the medicine to be placed closer to the irritated nerve root. The exposure to radiation is minimal.

After the procedure, the patient is examined again and then sent back to the ward. The patient is usually advised to go home in 2-3 hours.

#### Our Statistics from march 2007 to date

Transforaminal epidural steroid injections	74
Suprascapular blocks	21
Trigger point injections	15
Median nerve blocks for facetal arthropathy	8
Radiofrequency ablation	3
Lumbar sympathectomy	2



**Fig.2 Transforaminal spread of the radiopaque dye to confirm correct needle placement**

### Our experience

Most of the patients got substantial relief from pain, to the extent that they are able to do their normal work more comfortably and with less medication.

### Future Plans

We wish to introduce some more interventional techniques, which would be beneficial to our patients.

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- Physical Medicine and Rehabilitation Clinics of North America – May 2003.
- Text book on Pain Management by Steven. D. Waldman.

## PAIN RELIEF DURING LABOUR

The birth of the baby should be a comfortable and rewarding experience for the mother to be. Gentle exercise, breathing, posture and relaxation techniques help in early labour.

### Inhalation of gas:

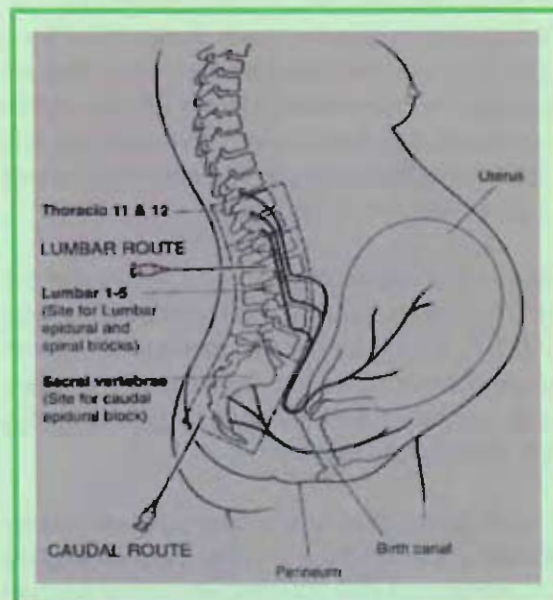
Pain relieving gas is often used to relieve labour pain. It is a mixture of oxygen and nitrous oxide (laughing gas). It is designed to provide as good a pain relief as possible without causing undue sleepiness. The gas works quickly, but takes about 30 to 45 seconds to have an effect. Some mothers feel light-headed during use. Occasionally nausea can be experienced, as can tiredness. Some mothers complain of a dry mouth. Gas mixtures help to relieve pain but will not remove it completely. The best use is to cope with short periods of pain, such as the time immediately before giving birth.

### Pain Killing Injections

They are used on request to relieve pain during labour. They are administered with an injection into the muscle of the thigh or buttock. These drugs can be of great benefit when used within the safe guidelines. The effect of each injection is around two to three hours. If given often, in big doses, or too close to the delivery of the baby, they can make both the mother and her baby sleepy and may delay successful breastfeeding.

### Epidural Analgesia

The nerves from the uterus (womb) and birth canal go to the brain through part of the lower back (see diagram). It is possible to infiltrate these nerves with local anaesthetic using an injection. A fine tube is placed in the region of the nerves so that painkiller can be injected. This can be repeated or 'topped up' when needed during labour. Positioning of this tube is done by an anaesthetist. For the second stage of labour, the 'top up' is usually injected with patient sitting up. This stops the pain from the lower nerves. This top up also allows a doctor to deliver the baby painlessly if assistance is required. Any stitching can be done while the epidural is still working. An epidural analgesia leaves mother pain free, but she may still have some sensation of pressure, particularly as baby is born.



### Advantages of Epidural

An epidural gives much more complete relief from discomfort in labour than any current alternative. Normally epidural analgesia is straightforward and very effective, with little risk of harmful effects. Most women find that an epidural makes their labour much more enjoyable.

### Disadvantages of Epidural

Incidence of instrumentation can increase.

## SCREENING FOR DISEASES AND ITS SIGNIFICANCE

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Medical Officer

Mandala Dispensary

One of the important developments in medical science and community, has been the emergence of screening for life-style disorders. As developing countries enter the twentyfirst century, non-communicable diseases are rapidly growing and adding to the existing burden of communicable diseases.

In recent years, chronic illnesses like Diabetes Mellitus, Hypertension, IHD, Cancer etc. have emerged as major public health problems among the urban population worldwide. Of the 150 million diabetics in the world, Indians alone account for 40 million cases. It is worrying to learn that diabetes in India would increase by 150-200% by 2025, not surprising then, that in 2025, every fourth person to be labelled a diabetic in the world, will be an Indian. The picture looks gloomier when we realize that many of our people with diabetes are still undiagnosed. Unfortunately, India harbours the largest population of prediabetes as well.

A World Health Organization analysis shows that the prevalence of hypertension in developing countries varies from 10-20% among adults. Hypertension and diabetes contribute a greater share to the development of coronary artery disease, which is the cause of 25-30% of deaths in most industrialized countries.

It is estimated that there are approximately 2-2.5 million cases of cancer in India at any given point of time with around 7,00,000 new cases being detected every year. Early detection and prompt treatment of early cancer and precancerous conditions, provide the best possible protection against cancer of the individual and the community. Among Indian women, cancer of the cervix and breast, account for nearly 60% of all cancers. Now, a good deal of attention is being paid to screening for early detection of cancers. It is important for elderly female individuals to undergo pelvic ultrasonography and PAP smear examination annually, to detect cancer

of the cervix at an early stage. Regular breast self examination and mammography in elderly women play a vital role in early detection of breast cancer. Stool for occult blood test and PSA test in elderly male individuals are important screening tests for recognizing colorectal cancer and prostatic cancer respectively.

Early detection is a common strategy for reducing the numbers and the chronicity of the diseases. It is assumed that a chronic disease progresses from a preclinical state to a clinical state. If an individual having preclinical disease participates in an early detection programme, the disease may be detected in the preclinical state.

The goal of screening is to reduce morbidity or mortality from the disease, by detecting diseases in their earliest stage, when treatment is usually more successful.

The active search for disease among apparently healthy people is a fundamental aspect of prevention. This is embodied in screening, which is defined as the search for unrecognized disease and detection by means of proper clinical examination, appropriate laboratory investigation or other procedures in an apparently healthy individual.

### Screening can be of 3 types

- A. Mass screening: means the screening of a whole population or a subgroup. It is offered to all, irrespective of the particular risk individual.
- B. High risk or selective screening: applied selectively to high risk groups like
  1. individual with genetic predisposition (family h/o DM, Hypertension, IHD, cancer etc.).
  2. having personal h/o smoking, tobacco chewing, alcohol dependence etc.
  3. exposure to occupational health hazards.
  4. having psychological stress.

C. Multiphasic screening: defined as the application of two or more screening tests in combination with a large number of people at one time than to carry out separate screening test for single diseases.

### The basic purpose of screening is

- To sort out from a group of apparently healthy adults, those likely to have the disease or at increased risk of the disease.
- To identify the risk factors which attribute to the pathogenesis of various chronic diseases.
- To monitor those adults who are already having diseases like Hypertension, Diabetes, IHD etc. and timely management of their complications as and when required.

- To modify the risk factors by motivating them to adopt healthy life style to prevent the onset of the disease or to delay the progression of the disease and their long term complications associated with the existing illness.

In this regard, a comprehensive study is being carried out in all the Dispensaries. Early detection through screening is our best defense against morbidity and mortality of various diseases.

### Additional Reading

1. WHO: Diet, Nutrition, prevention of chronic diseases.
2. Park's Text Book of preventive and social medicine.
3. Journal of IMA , Vol- 105, January'07, Diabetes.
4. Journal of IMA, Vol-103, September'05, Cancer.

## STROBOSCOPY – A TOOL FOR VOICE ASSESSMENT

**Dr. Pallavi Bhandarkar**  
Medical Officer

Department of ENT

Taking care of one's voice has become very important as a whole lot of professions depend on cultivated voice. Obviously importance of laryngology has grown in the last fifteen to twenty years and with that lot of advances are seen in instrumentation used by laryngologist. Videostroboscope is one such instrument which has changed modern laryngology practice.

### What is Stroboscopy?

Vibratory pattern of vocal folds is one of the crucial parameters to determine voice quality and production but is a complicated physiologic function. The unaided human eye is unable to visualize the vibratory patterns with a normal light source. Videostroboscope is an endoscope which is used with a special light source which flashes the light at frequency which either matches or does not match with a person who is being examined. When the frequency matches, the vocal cord movements are appreciated but not vibratory cycles and when frequency does not match, the vocal cord vibrations are seen on the screen. Thus it is the most useful and practical instrument, to visualise the vibratory pattern of vocal folds as well as detect any vocal pathology.

### Historical Background

To create an illusion of motion in the field of entertainment, a flashing light source was used and stroboscopic images were created. A Viennese scientist, Stamfer introduced the term 'stroboscope' for a device with rotating disc to create apparent motion. So the term is still used to connote a pulsatile light generating device devised to observe motion.

In 1895, an internist named Oertel used stroboscopic light source with laryngeal mirror to examine voice production in different voice registers. But due to limitations in illumination, poor image quality, lack of

technique for precise control of flashing frequency and patient discomfort, the technique did not find acceptance from the scientific community.

The credit for developing modern videostroboscopic technique goes to Dr. J.W. van den Berg at the University of Groningen, Dr. Rolf Timke at the University of Hamburg, Dr. Hans von Leden at the University of California and Dr. Elimar Schonharl in Erlanger. They wrote the first definitive book on stroboscopic examination of the larynx in 1960. With the advancements in fibreoptic light source intensity, optical image resolution, digital analysis and audio-video recording technology, the output of this objective test has been optimizing.

### Principle of stroboscopic examination:

The human adducted vocal folds cyclically open and close between 60 to 1500 times per second, depending on phonatory pitch. Stroboscopy capitalizes on the inherent optic properties of our visual organ and exploits the limitations of observation of the unaided eye. According to Talbot's law, the human eye can perceive no more than five distinct images per second. Each image lingers on the retina for approximately 0.2 seconds after exposure. Stroboscopic flashes make the vocal folds appear to slow down, by advancing the light pulse through successive glottal cycles in percentage increments. Individual still images are recorded at selected points from sequential vibratory cycles and the human eye automatically fills in the missing pieces by fusing the images into what it sees as motion. This apparent motion is attributable to a phenomenon called 'persistence of vision.'

A microphone picks up frequency of examinee's sustained voice, which triggers the stroboscopic light source. By synchronizing the stroboscopic flashes to



the fundamental frequency of the vibrating vocal folds, the perceptual standstill image of vocal folds is obtained. When the stroboscopic flashes are calibrated at frequency slightly different than the produced phonatory fundamental frequency, then successive light impulses strike at different phases of vibratory cycle and produce a video image of one apparent cycle of vibration. Thus it is not one whole cycle which is captured, but one apparent cycle which is constructed from different portions of several cycles.

### Instrumentation and Procedure

For performing stroboscopic examination, equipment needed includes -

Stroboscopic unit – It consist of light source and microphone and 70° or 90° rigid telescope/ fibreoptic laryngoscope.

For capturing and storing the images –

- A video camera - single chip or three chip
- A recording device
- A video monitor.

A) Stroboscopic light source – A microphone picks up the frequency of the examinee's sustained voice, which triggers the stroboscopic light source. As mentioned already this source has special mechanism by which light flashes can be emitted at a frequency either asynchronous to vocal frequency to get moving image or synchronous to it to get still image.

B) Rigid endoscope- It is commonly used because of its superior and magnified image but holding of the patient's tongue throughout the examination would distort the natural phonatory posture of the pharynx and larynx. Also, the patient must have suitable anatomy and the physical tolerance to allow the clinician to visualize the entire glottis.

Fibreoptic laryngoscope has advantage of stroboscopic examination being carried out with normal phonetic behaviour as there is no need to protrude the tongue. But the disadvantage is there is no magnified view and the low intensity of light carried through the long fiberoptic bundle to the tip of the narrow endoscope gives comparatively poorer image. With standard endoscopes, the light bouncing off objects being observed must then travel the length of the endoscope

back to a camera for image capture. This has been overcome by introducing distal chip technology for fibreoptic endoscopes.

C) The camera, monitor and recording device- They are equally important for image capture for the purpose of documentation, reproduction and as a teaching tool.

### Procedure

This examination is done in sitting position with patient's throat sprayed with local 4% xylocaine spray. Patient is asked to extend neck at atlantoaxial joint, protrude the tongue and breath through mouth. The protruded tongue is held by examiner or patient himself with a piece of lint cloth

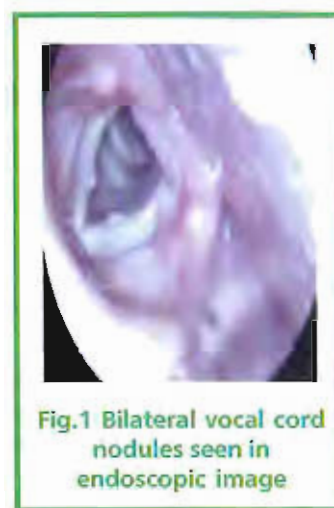


Fig.1 Bilateral vocal cord nodules seen in endoscopic image

throughout the examination. The rigid endoscope with camera attached is introduced taking care it does not touch posterior pharyngeal wall to avoid gag reflex and rests on tongue. Once the larynx of the patient is visualized patient is asked to do phonatory tasks like saying 'eee' at low, normal and high pitches and in the range of speaking or singing if that is a problem area. The examination is recorded and later can be interpreted with standardized protocol.

### Clinical Parameters

The following parameters are evaluated while performing stroboscopy -

- **Fundamental frequency:** The fundamental frequency is measured by using the strobe unit and used to set the frequency of the light flashes. Strobe light is typically produced at a frequency several hertz slower than the vocal frequency to produce the illusion of a slow-motion vibratory cycle. An identical frequency is emitted in the locked mode that produces a still image of a single portion of the vibratory cycle.

- **Periodicity:** Periodicity refers to the regularity of successive vocal motions. Normal vibratory activity is regular and periodic.
- **Amplitude:** Amplitude refers to the lateral excursion of the vocal folds during their displacement away from the midline in oscillation. Typical amplitude is approximately one third of the total width of the vocal fold. Amplitude is generally graded as normal, less than normal or greater than normal.
- **Symmetry:** Normal motion of the vocal folds is symmetric, both in vibratory characteristic and in adductory and abductory motion.
- **Glottic closure:** In a healthy person, the membranous portion of the vocal folds completely closes during the vibratory cycle. The posterior cartilaginous glottis may remain open (posterior glottic chink) in some healthy people.
- **Mucosal wave:** The pattern of light traveling from mediolaterally along the superior surface of the vocal fold during vibration under illumination, is referred to as the mucosal wave. It is a correlate of the pliable cover (epithelium and superficial lamina propria) of the vocal fold being displaced relative to the body of the vocal fold (vocalis muscle). Focal abnormalities of mucosal wave help to localize pathology in the vocal fold.

## Clinical Applications

### 1) Vocal Cord Nodules

They are bilaterally symmetrical lesions and present at the junction of anterior 1/3<sup>rd</sup> and post 2/3<sup>rd</sup> of the vocal cord. It occurs at basement membrane zone present in epithelium and superficial lamina propria. Although mucosal wave is present, it is reduced and amplitude is also reduced. Glottic closure has hour glass pattern.

### 2) Vocal Fold Cyst

They are encapsulated lesions present within vocal fold lamina propria and can affect vibratory characteristics of vocal cord maximum. Vocal fold cyst is usually unilateral and single. It gives vocal fold full and rounded appearance. The vibratory pattern is asymmetrical with diminished amplitude. Mucosal wave is absent on the cyst itself and decreased in rest of the vocal fold. When the cyst is small and not obviously seen on laryngeal

examination, reduced vibratory pattern is the only physical finding noted.

### 3) Vocal Fold Polyp

Polyp is either bilateral or unilateral and occurs in superficial lamina propria. Glottic closure would show gaps anterior and posterior to the lesion. Mucosal wave might be present but diminished. The vibratory pattern is asymmetrical and amplitude is decreased near the lesion.

### 4) Sulcus Vocalis

It is a focal furrow in the covering of vocal fold. It represents a tethering of epithelium to the underlying connective tissue and is usually unilateral. Glottic closure is incomplete and there is focal interruption of mucosal wave at the site of sulcus. The vibratory pattern of the vocal folds is asymmetrical.

### 5) Early Carcinoma in Situ

Appropriate endoscopic management of early glottic carcinoma requires evaluation of its superficial and deep extension, to minimise any excessive removal of healthy tissue as well as to make sure that disease has been excised with adequate margins.

Stroboscopy helps in initial evaluation and presence of mucosal wave can differentiate microinvasive early glottic carcinoma from frankly invasive carcinoma. When lesion is extending to only epithelium, mucosal wave is maintained. If lamina propria is invaded by carcinoma, mucosal wave would be reduced or absent.

False positive findings are seen in the presence of adjacent inflammatory changes.

## Limitations

1. The video image obtained is composite of several glottal cycles where different portions of several cycles are merged to form one image. Thus it is one apparent cycle and not one entire vibratory cycle of vocal cords, so cycle-to-cycle variations are not recorded.



**Fig.2 Right vocal cord cyst with vocal cords closure showing gap between the cords.**

2. The interpretation of examination depends on skills and experience of examining clinician as well as of clinician who is interpreting the data.
3. The quality of images obtained is directly proportional to skills and experience of operator performing the examination.
4. Vocal fold vibration must be relatively periodic to visualize slow motion representation of phonatory cycle.

The first and fourth limitations have been overcome with Videokymography, a method of examination which is based on high speed glottography. It evaluates one portion of glottis in comparison to another and its applicability is not limited to vibratory periodicity as seen with videostroboscopy.

Period – January 2007 to July 2008

Number of Patients – 86

Age- All patients were above 15 years of age

### Criteria for selecting patients for stroboscopy

- 1) Patients with hoarseness of voice
- 2) Patients who showed vocal cord pathology on fibreoptic laryngeal examination in the absence of any laryngeal symptoms. 24 patients could not undergo rigid laryngeal stroboscopic examination due to sensitive gag reflex or epiglottis obstructing the laryngeal view or anterior larynx. Stroboscopy was performed with fibreoptic laryngoscope in these patients.

### Videostroboscopic larynx assessment –An Experience at BARC Hospital

LARYNGEAL PATHOLOGY	NUMBER OF PATIENTS
VOCAL CORD NODULES	17
VOCAL FOLD CYST	4
VOCAL CORD POLYP	7
VOCAL CORD PALSY	6
LEUKOPLAKIA OF VOCAL CORD	4
INVASIVE CARCINOMA OF V.C.	4
SULCUS VOCALIS	3
PUBOPHONIA	2
ADDUCTOR SPASMODIC DYSPHONIA	4
ABDUCTOR SPASMODIC DYSPHONIA	2
<b>NO PATHOLOGY</b>	<b>33</b>

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*"Words mean more than what is set down on paper. It takes the human voice to infuse them with shades of deeper meaning."*

- Maya Angelou  
American poetess,

Important figure in the American Civil Rights Movement.

## COLLECTION AND TRANSPORTATION OF CLINICAL SPECIMENS FOR DIAGNOSTIC MICROBIOLOGY

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The laboratory diagnosis of an infectious disease, begins with the collection of a clinical specimen for examination or processing in the laboratory (the right one, collected at the right time, transported in the right way to the right laboratory). Proper collection of an appropriate clinical specimen is the first step in obtaining an accurate laboratory diagnosis of an infectious disease. Guidelines for the collection and transportation of specimens must emphasize two important aspects:

- Collection of the specimen before the administration of antimicrobial agents.
- Prevention of contamination of the specimen with externally present organisms or normal flora of the body.

General rules for collection and transportation of specimens

Use standard precautions for collecting and handling all specimens and apply strict aseptic techniques throughout the procedure:

- Wash hands before and after the collection.
- Collect the specimen at the appropriate phase of disease.
- Make certain that the specimen is representative of the infectious process (e.g. sputum is the specimen for pneumonia and not saliva) and is adequate in quantity for the desired tests to be performed.
- Collect or place the specimen aseptically in a sterile and/or appropriate container.
- Ensure that the outside of the specimen container is clean and uncontaminated.
- Close the container tightly so that its contents do not leak during transportation.
- Label and date the container appropriately and complete the requisition form.

- Arrange for immediate transportation of the specimen to the laboratory.

### Criteria for rejection of specimens

Criteria should be developed by a laboratory, on the basis of which the processing of a specimen may not be done by the laboratory. Following are some examples:

- Missing or inadequate identification.
- Insufficient quantity.
- Specimen collected in an inappropriate container.
- Contamination suspected.
- Inappropriate transport or storage.
- Unknown time delay.
- Hemolyzed blood sample.

### Collection of specimens

The clinical state of the patient will not necessarily be reflected by the result of laboratory investigation, despite correct laboratory performance unless the specimen is in optimal condition required for the analysis. Some of the important specimens and their proper collection and transportation methods are described here so as to ensure quality.

#### Blood

Whole blood is required for bacteriological examination. Serum separated from blood is used for serological techniques. Collection of Blood for culture must be obtained aseptically. Careful skin preparation before procedure is essential. Choose the vein to be drawn by touching the skin before it has been disinfected. Using 70% alcohol, cleanse the skin over the venipuncture site in a circle approximately 5cm in diameter, rubbing vigorously. Allow to air dry. Starting in the centre of the

circle, apply 2% tincture of iodine or povidone-iodine in ever-widening circle until the entire circle has been saturated with iodine. Allow the iodine to dry on the skin for at least 1 minute. Insert the needle into the vein and withdraw blood. After the needle has been removed, the site should be cleaned with 70% alcohol again, because many patients are sensitive to iodine.

Once removed from circulation, unclotted blood must be diluted in an enrichment media such as Brain-heart infusion broth to facilitate growth of the organisms present in blood. While collecting blood for culture, the following points must be remembered:

- Collect blood during the early stages of disease since the number of bacteria in blood is higher in the acute and early stages of disease.
- Collect blood during paroxysm of fever since the number of bacteria is higher at high temperatures in patients with fever.

### Specimen Volume

There is direct relationship between the volume of blood and the yield. Chances of isolating the organism is greater, if larger volume of blood is cultured. Infants and small children generally have high levels of bacteremia, hence smaller volumes are acceptable. For adults with a suspected Blood Stream Infection (BSI), collect two initial sets of blood cultures sequentially from separate phlebotomy procedures followed by a third and a fourth set at 4-6 hour intervals (will detect >99% of BSIs). Three sets of blood cultures collected within a 24 hour period will detect 96.9 - 98.3% of BSIs. A single set of blood cultures to detect BSIs in adults is inadequate (only 73% sensitivity); two sets of blood cultures will allow detection of 87.7-89.7% of BSI episodes. (J Clin Microbiol 2007; 45:3546).

### CerebroSpinal Fluid (CSF)

Examination of CSF is an essential step in the diagnosis of any patient with evidence of meningeal irritation or affected cerebrum. Almost 3-10 ml of CSF is collected and part of it is used for biochemical, immunological and microscopic examination and remaining for bacteriological or fungal examination. The following important precautions need to be taken for CSF collection and transportation:

- Collect CSF before antimicrobial therapy is started.
- Collect CSF in a sterile container and do not delay transport and laboratory investigations.
- The carrier should place the specimen in the hands of the person in charge of processing the culture and NOT in the refrigerator or on the bench.
- CSF is a precious specimen, handle it carefully and economically. It may not be possible to get a repeat specimen.
- Perform physical inspection immediately after collection and indicate findings on laboratory requisition form.
- Store at 37°C, if delay in processing is inevitable. Do not refrigerate.

### Sputum

Sputum is processed in the laboratory for etiological investigation of bacterial and fungal infections of the lower respiratory tract. It is of utmost importance in the diagnosis of pulmonary tuberculosis.

- Select a good wide-mouthed sputum container, which is preferably disposable, made of clear thin plastic, unbreakable and leak proof material.
- Give the patient a sputum container with the laboratory serial number written on it. Show the patient how to open and close the container and explain the importance of not rubbing off the number written on the side of the container.
- Instruct the patient to inhale deeply 2-3 times, cough up deeply from the chest and spit in the sputum container by bringing it closer to the mouth.
- Make sure the sputum sample is of good quality. A good sputum sample is thick, purulent and sufficient in amount (2-3 ml).

### Urine

Under normal circumstances urine is sterile.

The lower part of the urethra and the genitalia are normally colonized by bacteria, many of which may also cause urinary tract infection. Since urine is a good growth medium for all sorts of bacteria, proper and aseptic collection assumes greater importance for this specimen.

For microbiological examination urine must be collected as a "clean catch-mid-stream" specimen.

## Stool

Faecal specimens for the aetiological diagnosis of acute infectious diarrhoeas should be collected in the early stage of illness and prior to treatment with antimicrobials. A stool specimen rather than a rectal swab is preferred.

- The faeces specimen should not be contaminated with urine.
- Collect the specimen during the early phase of the disease and as far as possible before the administration of antimicrobial agents.
- 1 to 2 gm quantity is sufficient.
- If possible, submit more than one specimen on different days.
- The fresh stool specimen must be received within 1-2 hours of passage.
- Store at 2-8°C.

In cases of suspected cholera, the faeces specimen may be sent in Alkaline peptone water as it enhances the growth of vibrios.

## Throat Swab

- Depress the tongue with a tongue blade.
- Swab the inflamed area of the throat, pharynx or tonsils with a sterile swab taking care to collect the pus or piece of membrane.
- Transport in sterile tube.

## Surgical Material

- Material from Biopsy, Abscess, Ulcers, Fistulae, Sinuses, Wound: Remove the tissue aseptically from the lesion, including the wall and centre of the lesion.
- Curette sinus tracts so as to include the wall of the tract. Collect tissue in sterile tubes. Tissue or aspirates are always superior to swab specimens.
- Remove surface exudate by wiping with sterile saline or 70% alcohol.
- Aspirate with needle and syringe. If a swab must be used, pass the swab deep into the base of the lesion to firmly sample the fresh border.

- Deliver all specimens to the laboratory immediately after collection.
- Do not add water, saline or formaldehyde to the sample.
- Send the swabs to the laboratory immediately to avoid drying of the swabs.
- For amoebic cultures, avoid delay in sending the sample to the laboratory as motility of trophozoites are seen only in fresh samples.
- Proctoscopic and duodenal aspirates may be sent for *G. lambilia* and *S. stercoralis*.

## Bone Marrow

Bone marrow is collected by a doctor who is well trained in this procedure

- Decontaminate the skin overlying the site from where specimen is to be collected with 70% alcohol followed by 2% tincture of iodine.
- Collect in a sterile tube.
- Send to laboratory immediately.

## Rectal Swab

- Insert swab at least 2.5 cm beyond the anal sphincter so that it enters the rectum.
- Rotate it once before withdrawing.
- Transport in sterile tube.

## Ear

### a. Inner ear

Tympanocentesis should be reserved for complicated, recurrent, or chronic persistent otitis media. For intact eardrum, clean ear canal with soap solution and collect fluid via syringe aspiration. Submit in sterile container. For ruptured eardrum, collect fluid on flexible shaft swab via an auditory speculum. Transport time <2 hours.

### b. Outer ear

Use moistened swab to remove any debris or crust from ear canal. Obtain sample by firmly rotating swab in outer canal. For otitis external, vigorous swabbing is required – surface swabbing may miss streptococcal cellulitis.

## Eye

### a. Conjunctiva

Sample each eye with separate swabs (premoistened with sterile saline) by rolling over conjunctiva. When only one eye is infected, sampling both can help distinguish indigenous microflora from true pathogens.

### b. Corneal scrapings

Collected by ophthalmologist. Using sterile spatula, scrape ulcers and lesions; inoculate scraping directly onto media. Prepare 2 smears by rubbing material onto 1-2 cm area of slide. Transport time <15 min.

### c. Vitreous fluid

Prepare eye for needle aspiration of fluid. Transfer fluid to sterile tube. Transport time <15 min.

## Catheter Tips

Only intravascular catheter tips from pediatric patients and peritoneal dialysis catheters are routinely accepted for culture. Send 5 cm of distal tip in sterile container. Transport time <15 min. Foley catheters are not accepted for culture, since growth represents distal urethral flora.

## Transportation of Specimens

- Ideally specimens should be transported to the laboratory within 30 minutes of collection.
- Many micro-organisms are susceptible to environmental conditions such as the presence of oxygen (anaerobic bacteria), changes in temperature (*Neisseria meningitidis*) or changes in pH (*shigella*).
- Thus use of special preservatives or holding media like alkaline peptone water, thioglycollate broth for transportation of specimens delayed for more than 30 minutes is important in ensuring organism viability (survival).
- Specimens to be sent to other laboratories require special attention for safe packing of the material. Guidelines are usually issued by national authorities and the same should be strictly followed.
- For hand-carried transportation over a short distance, the specimen should be placed upright in appropriate racks.

## Additional Reading

1. WHO, Regional Office for South-East Asia Publication 2006, In Guidelines on Standard Operating Procedures for Microbiology Chapter-2 Collection and Transportation of Clinical Specimens.
2. Lennette HE, Balows A, Hausser WJ et al. Collection, Handling and Processing of Specimen. In Manual of Clinical Microbiology, 4th Ed, ASM, Washington, DC, 73-98, 1985.
3. El-Nageh, Heuck CC, Appel W, Vandepitte et al. Basics of quality assurance in peripheral laboratories. WHO EMRO Series No 2, Alexandria, 1992.
4. Forbes BA, Sahm DF, Weissfeld AS, editors: Bloodstream Infections. In Bailey and Scott's Diagnostic Microbiology. 11<sup>th</sup> ed. Philadelphia: Mosby, Inc.1998. 864-883.
5. Mermel LA and Maki DG: Detection of bacteremia in adults: consequences of culturing an inadequate volume of blood, Ann Intern Med 1189:270,1993.

### TRANSPORT MEDIA FOR TISSUE KARYOTYPING

<b>TISSUE</b>	<b>MEDIA</b>
Product of Conception	Normal saline in Sterile Container
OR	+
Placental tissue	4-5 drops of inj Gentamycin / inj Pencillin



## ACHIEVEMENTS / PRESENTATIONS / PUBLICATIONS

### • ACHIEVEMENTS

- Dr. Umesh D. Kalane, Postgraduate student from Department of Paediatrics secured Gold Medal in the Diplomate of National Board Examination conducted in the subject of Paediatrics, in June 2007.
- Dr. Tanuja P. Karande and Dr. Shilpa S. Sule postgraduate students from the Department of Paediatrics were first Runner - Ups in the post graduate Quiz conducted by the Indian Academy of Paediatrics in Mumbai Zone, in September 2007.

### • PRESENTATIONS

#### OCCUPATIONAL HEALTH UNIT TROMBAY DISPENSARY

Dr. V. Karira, Head, Medical Division and Dr. P.R. Bongirwar, Medical Officer in charge, Trombay and Vashi Industrial Dispensaries participated, on an invitation from the Supervising Director, Research Centre for Radiation Emergency Medicine of National Institute of Radiological Sciences (NIRS), Chiba, Japan in an International Workshop held jointly by NIRS and Nuclear Safety Commission (NSC) of Japan and supported by International Atomic Energy Agency (IAEA) from January 30 to February 1, 2008 at Chiba, Japan. They made a joint presentation on 'Radiation Emergency Medical Preparedness and Response: An Indian Scenario' during the event and actively participated in various deliberations and discussions held during the workshop.

#### • Department of Obstetrics and Gynaecology

- Case report – Rare and interesting- case of nongestational choriocarcinoma by Dr. Preeti Mishra, Dr. Amrita Misri, Dr. D.P. Joshi. Presented at the 36<sup>th</sup> Annual Conference of the Mumbai Obstetric and Gynaecological Society, on January 26<sup>th</sup> and 27<sup>th</sup>, 2008, at Mumbai.
- Case study: Induction of labour with PGE2 gel in term PROM patients by Dr. Bahadur Rao, Dr. Misri, Dr. Joshi, Dr. Motiwale, Dr. Prabhu and Dr. N. Mishra. Presented at the 36<sup>th</sup> Annual Conference of the Mumbai Obstetric and Gynaecological Society, on January 26<sup>th</sup> and 27<sup>th</sup>, 2008, at Mumbai.

#### • Department of Radiology

- Case study- Does ultrasound abdomen help in early diagnosis of Dengue fever by Dr. Surita Kantharia. Presented at the 61<sup>st</sup> National Conference Indian Radiological and Imaging Association, held in January 2008, at Bangalore.

#### • Department of Ophthalmology

Postoperative outcomes with Heparin surface modified IOLs in traumatic cataract - Our experience by Dr. Shashank Ranade, Dr. V. Karaira, Dr. S. Nadkarni and Dr. R. Baile. Presented at the 27<sup>th</sup> Annual conference of Maharashtra Ophthalmic Society on 27<sup>th</sup> October 2007, at Solapur.

- **Department of Psychiatry**

Poster presentation: Have the profiles of child psychiatry referral changed over time? by Smt. Anita Patil, Dr. Shobha Nair, Dr. K. Mazumdar and Dr. Smt. S.V. Patkar. Presented at the IX Biennial Conference of Indian Association for Child and Adolescent Mental Health in November 2007.

- **DEPUTATION**

Dr. N. Roy was deputed to Johns Hopkins University, Baltimore, Maryland for 10 months for "Masters in Public Health" (MPH) from July 2007 to May 2008.

- **PUBLICATIONS**

Hyperbilirubinemia in Normal Healthy Donors by Dr. Veena Arora, Dr. R.K. Kulkarni and Dr. Susan Cherian, Department of Pathology. Accepted for publication in the Asian Journal of Transfusion Science in July 2008.

**Medical Division, BARC has started 24 hrs. Casualty Services. All the Casualty Medical Officers and Resident Medical Officers are handling casualty services quite efficiently.**

**The first issue of 'Medical Guidelines For Patient Care', focusing on various protocols/ guidelines to be followed in casualty, has been published in January 2008.**



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