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Endocarditis: A clinical microbiologist's viewpoint

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Abstract: Endocarditis is an infective condition that poses a major challenge to cardiologists, cardiac surgeons, infectious disease physicians and microbiologists alike. Despite substantial improvements in the diagnosis and management of this infective condition, it is still associated with a significant morbidity and mortality. This article reviews the epidemiological features, clinical presentation, diagnostic methodology, microbiology, treatment and prevention of infective endocarditis and highlights the differences seen between India and the West. An attempt has been made to cover the relevant aspects of this not so infrequent infective condition that is associated with a considerable morbidity and mortality.

Epidemilogical Features

The incidence of infective endocarditis (IE) is difficult to determine, yet most western studies place it at approximately 2-6 per 100 000 person-years. However, in India there is a complete lack of data regarding the exact incidence of this disease.

In the West, the mean age of patients with IE has gradually increased, *the median age* was 30-40 years during the pre-antibiotic era and is 47-69 years now.[1,2] Among patients with endocarditis associated with injection-drug use, there is a trend towards younger people being affected. Though studies are few, in India the young population is mainly affected by IE, the mean age being 24 years with 90% aged <40 years as seen in a large referral hospital in northern India.[3] In India, as in the West, males are more often affected than females.[3,7] Whether they are adults or children, the male to female ratio is 2.5:1 in India versus an average of 1.7:1 in the West.

In India, rheumatic heart disease has been found to be the most frequent underlying heart lesion in IE patients (even up to 60%).[3,5] This again is in contrast to that seen in the West, where mitral valve prolapse is the commonest cardiovascular abnormality predisposing to IE.[6] Congenital heart disease ranks second with ranges from 27.3% to 33% seen in various Indian studies.[3] Intravenous drug abuse is another important predisposing condition in the West but is rare in the Indian setting.[8,9]

Clinical Manifestations

Fever is the most common presentation but may be absent (5% of the cases) or minimal in several situations, especially in *the setting of* congestive heart failure, chronic renal or liver failure, severe debility, previous antimicrobial therapy or IE caused by less virulent organisms.[6] Persistent fever during antimicrobial therapys though relatively infrequent, is an ominous sign. Prolonged fever (≥2 weeks duration) is associated with the following:

i) Specific aetiologic agents-*Staphylococcus aureus*, Gram-negative bacilli, fungi, culture-negative endocarditis; and

ii) Microvascular phenomena, embolization of major vessels, intracardiac (e.g. myocardial) abscess, peripheral complications, tissue infarction, pulmonary emboli, drug reactions, a need for cardiac surgery and *a* higher mortality rate.

The clinical features of prosthetic valve endocarditis (PVE) are essentially similar to those of native valve endocarditis (NVE). However, there is a higher frequency of new or changing regurgitant murmurs, congestive heart failure, persistent fever in spite of optimal antimicrobial therapy, and new electrocardiographic conduction disturbances, than those seen in NVE. Nosocomial infective endocarditis, on the other hand, usually has an acute onset and signs of endocarditis are infrequent.

Diagnosis

The diagnosis of IE is based on a combination of clinical, laboratory and echocardiographic data. Non-specific laboratory parameters may be abnormal but none is diagnostic. Anaemia, leucocytosis, thrombocytopenia, abnormal urinalysis results; *and an* elevated erythrocyte sedimentation rate and C-reactive protein level may all be present.

Over the years, various diagnostic criteria for IE have been proposed, such as the Beth Israel criteria in 1982 and the Duke criteria in 1994.[10] These criteria combine factors predisposing patients to the development of IE, the blood culture isolate and persistence of bacteraemia and echocardiographic findings along with other clinical and laboratory information. A modified version of the Duke criteria has recently been proposed (Table 1).[11]

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Table 1. Proposed criteria for the diagnosis of infective endocarditis

Criteria	Description
Major criteria	Typical microorganism isolated from two separate blood cultures: viridans streptococci, *Streptococcus bovis*, HACEK group, *Staphylococcus aureus*, or community-acquired enterococcal bacteraemia without a primary focus or Microorganism consistent with IE isolated from persistently positive blood cultures or Single positive blood culture for *Coxiella burnetii* or phase I IgG antibody titre to *C. burnetii* >1:800
a) Microbiological	
(b) Evidence of endocardial involvement	New valvular regurgitation (increase or change in pre-existing murmur not sufficient) or Positive echocardiogram (transoesophageal echocardiogram recommended in patients who have a prosthetic valve, who are rated as having at least possible IE by clinical criteria, or who have complicated IE)
Minor criteria	Predisposition to IE that includes certain cardiac conditions and injection-drug use Fever >38°C (100.4° F) Vascular phenomena Immunological phenomena Microbiological findings
Diagnosis	Definite endocarditis Two major criteria, or One major and three minor criteria, or Five minor criteria Possible endocarditis One major and one minor criteria, or *Three* minor criteria

HACEK: *Haemophilus* species (*H. parainfluenzae, H. aphrophilus*, and *H. paraphrophilus*), *Actinobacillus actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens* and *Kingella kingae*.

Blood culture

The single most important laboratory test of diagnostic significance to both the clinician and the clinical microbiologist is the blood culture.[12] The site chosen for venepuncture is important. Femoral sites or sites with dermatological disease will often yield a higher rate of contamination. It must be remembered that arterial blood does not provide a higher yield than venous blood.

Adequate cleansing of the selected site is done with 70% isopropyl or ethyl alcohol applied concentrically, starting at the centre. The skin should be allowed to dry. This is followed by a second cleansing with an iodophor or tincture of iodine over the same area. The disinfectant should be allowed to dry completely. In iodine allergy, a double application of alcohol should be used for skin disinfection. Sterile gloves should be used throughout the procedure. Blood cultures should be obtained preferably by fresh venepunctures, not through indwelling intravascular devices to minimize contamination. Changing needles after venepuncture and before inoculation of blood into the culture media has not shown decrease in the rate of contamination.

It is believed that the best time to obtain blood for culture is just before the onset of chills or fever spikes. However, the continuous nature of most bacteraemia in IE renders timing less important.[13]

In acute endocarditis, two to three blood samples should be obtained quickly within 5 minutes of each other prior to starting antibiotic therapy. On the other hand, in subacute endocarditis, several (3 or more) blood samples should be obtained 30 minutes to 1 hour apart over several (24) hours, to establish a specific and conclusive microbiological diagnosis. Multiple blood cultures are necessary to demonstrate the presence of continuous bacteraemia, differentiate between contamination and true bacteraemia, and to know if the patient has received antibiotics in the preceding 2 weeks.

At least 10 ml (in adults) and 1-5 ml (in infants and children) of blood should be cultured in more than one type of blood culture medium, e.g. 1 in trypticase soy (or brain-heart infusion) broth and 1 in thioglycolate broth, to increase the chances of recovery of certain microorganisms. The new commercial media are also effective with the additional ability to counteract or neutralize the inhibitory effect of antibiotics (BACTEC or BacT Alert). If there is a high suspicion of IE due to anaerobes, then one anaerobic bottle should be included among the total 2-6 bottles inoculated from the samples drawn.

Inspection for macroscopic growth should be done daily and routine subcultures done on days 1, 3 and 5. Modern commercial blood culture systems demonstrate recovery of clinically significant microorganisms within 5 days. The older manual blood culture systems required at least 2-3 weeks of incubation. However, it is probably wiser to incubate these bottles for 3 weeks so as to maximize the chances of positive results.

Blood cultures may be negative in 2.5%-31% of cases, i.e. the so-called blood culture-negative IE. Previous antibiotic therapy, right-sided, mural or prosthetic valve endocarditis and slow-growing or fastidious organisms are responsible for most of these cases.

If blood cultures from patients remain negative after 5-7 days of incubation, one must consider prolonged incubation and the plating of subcultures on a more enriched medium.

ECHOCARDIOGRAPHY

Echocardiograms have correctly identified vegetations on all valves even in culture-negative cases. However, transthoracic echocardiography (TTE) may be inadequate in up to 20% of adult patients owing to obesity, chronic obstructive pulmonary disease or chest wall deformities; the overall

sensitivity is variable (<50% to >90% positive). It is of great value in assessing local complications of IE, especially those surrounding the aortic valve. Transoesophageal echocardiography is more sensitive and cost-effective than conventional TTE in the detection of intracardiac vegetations (approximately 95% and 60%-65%, respectively), particularly in the setting of prosthetic valves.

Microbiology

Many studies have shown that streptococci, especially viridans streptococci, are responsible for the largest proportion of cases.[4,5,7,14] Other studies have found staphylococci to be more frequent.[3,6] Which of these is more frequent depends on whether native valve endocarditis occurs in addicts or non-addicts. A similar situation exists in early versus late PVE.[15]

Endocarditis due to enteric Gram-negative bacteria is uncommon though the incidence is increasing: even in India. *Salmonella*, *Enterobacter*, *Citrobacter*, *Escherichia coli*, *Klebsiella*, *Serratia marcescens*, *Proteus*, *Pseudomonas*, and *Providencia*: have all been implicated.[3,8,9] Persistent bacteraemia is common even with high levels of antimicrobial activity and the prognosis is poor. In the early postoperative period after prosthetic valve replacement, sustained Gram-negative bacillary bacteraemia does not necessarily imply IE, and other foci of infection (sternal wound, pneumonia, urinary tract, intravenous catheters, etc.) should be carefully sought. Bacteraemia persisting for days before treatment or for ≥72 hours after the removal of an infected catheter and initiation of treatment, especially in patients with abnormal heart valves or prosthetic valves, suggests the development of nosocomial infective endocarditis.

Other Gram-negative bacteria such as *Neisseria*, *Haemophilus*, *Actinobacillus* spp. *Cardiobacterium* spp., *Eikenella* spp. and *Kingella* spp. have also been implicated in IE. Gram-positive bacilli *(Corynebacterium)* and anaerobic organisms, though not common, have also been reported. Fungal endocarditis is common in patients who have received prolonged antibiotic therapy, are on indwelling intravascular devices, or have undergone reconstructive cardiovascular surgery.[14,15] Narcotic addicts are also prone to this form of endocarditis. Many species of *Candida* and *Aspergillus* have been implicated.[15] These cases are usually difficult to treat and the prognosis is frequently poor.

Table 2 lists some common pathogens causing IE in various clinical situations and Table 3 lists the common pathogens found in various categories of patients in decreasing order of importance.

Prophylaxis

The American Heart Association (AHA) has formulated extensive guidelines for the prevention of bacterial endocarditis.[16] Though definitive data are lacking, of the various preventive measures that could be employed, appropriate administration of antibiotics before procedures expected to produce bacteraemia has received the *most* attention. The AHA lists the procedures requiring or not requiring endocarditis prophylaxis. Specific recommendations for the use of antibiotics for prophylaxis are also included and can be obtained from standard references.[16]

Table 2. Common pathogens in various clinical situations

Common pathogens	Clinical situations
Staphylococcus aureus	Intravenous drug abuse, infected intravascular catheter
Enterococci	Manipulation of genitourinary tract
Streptococcus bovis	Elderly, gastrointestinal malignancy and colonic polyps
Streptococcus mutans	Dental caries
Streptococcus pneumoniae	Alcoholics
Streptococcus mitis	Drug addicts
Gram-negative bacilli	Drug addicts, prosthetic valve recipients and patients with cirrhosis
HACEK	Pre-existing valvular disease, drug addicts and dental procedures
Fungi	Drug addicts, reconstructive cardiovascular surgery, prolonged intravenous or antibiotic therapy

Table 3. Common pathogens in various categories of patients

Category	Common pathogens
Neonates	*Staphylococcus aureus*, CNS, group B streptococci, occasionally GNB
Older children	Streptococci, *S. aureus*
IVDA	*Staphylococcus aureus*, *Pseudomonas*, other GNB, HACEK group, fungi
NVE, PVE >12 months after surgery	MSSA, streptococci, GNB, fungi
PVE <2 months, between 2-12 months after surgery	CNS, MRSA, GNB
Nosocomial endocarditis	*Staphylococcus aureus*, CNS, enterococci, streptococci, *Candida* spp., GNB

CNS: Coagulase-negative staphylococci; NVE: native value endocarditis; PVE: prosthetic valve endocarditis; MSSA: methicillin-sensitive *Staph.* aureus; MRSA: methicillin - resistant *Staph* aureus HACEK (See table1.)

Compliations

The complications of endocarditis are well known. These may be cardiac, embolic, neurological or renal. The most prevalent complications are congestive heart failure, paravalvular abscess formation and embolism (especially stroke). In addition, endocarditis may be complicated by septic arthritis, vertebral osteomyelitis, pericarditis, metastatic abscesses, and an array of renal problems ranging from immune complex glomerulonephritis to renal abscesses. Further, complications as a result of medical treatment of endocarditis can result in ototoxicity and nephrotoxicity, skin rashes and serum sickness.[17]

Table 4. Usual antimicrobial therapy for various causes of infective endocarditis

Pathogen	Native valve endocarditis (NVE)		Prosthetic valve endocarditis (PVE)	
	Antimicrobial therapy	Comments	Antimicrobial therapy	Comments
Penicillin susceptible viridans Streptococci, *Streptococcus bovis*, and other streptococci (MIC of penicillin ≤ 0.1 μg/ml)	Penicillin G 10-20 million units i.v./day in 6 equally divided doses for 4 weeks or Ceftriaxone 1 g i.v. q 12 hour for 4 weeks If immediate hypersensitivity to beta-lactam antibiotics use Vancomycin 30 mg/kg/day i.v. (total dose <2 g/day)	2 week regimen of Penicillin G (or Ceftriaxone) in the doses as mentioned with Gentamicin 1 mg/kg i.m. or i.v. is optional. Exceptions– myocardial abscess, extracardiac foci of infection, PVE	Penicillin G 10-20 million units i.v./day for 6 weeks and Gentamicin 1 mg/kg i.m. or i.v. for 2 weeks If immediate hypersensitivity to beta-lactam antibiotics use Vancomycin 30mg/kg/day i.v. (total dose ≤ 2g/day)	Shorter duration of treatment with an aminoglycoside (2 weeks) is usually appropriate for PVE due to Penicillin susceptible viridans Streptococci, S. bovis, or other streptococci with MIC of Penicillin ≤ 0.1 μg/ml
Relatively penicillin-resistant streptococci (MIC of penicillin >0.1-0.5 μg/ml)	Penicillin G 20 million units i.v./day in 6 equally divided doses for 4 weeks and Gentamicin 1 mg/kg i.m. or i.v. for 2 weeks		Penicillin G 20 million units i.v./ day in 6 equally divided doses for 6 weeks and Gentamicin 1 mg/kg i.m. or i.v. for 4 weeks	
Streptococcus species (MIC of penicillin >0.5 μg/ml), *Enterococcus* species, or *Abiotrophia* species	Penicillin G 20-30 million units i.v./day for 4-6 weeks or Ampicillin 12 g i.v. in 6 equally divided doses/day for 4-6 weeks with Gentamicin 1 mg/kg i.m. or i.v. (single dose of 80 mg) q 8 hour for 4-6 weeks	Six weeks of therapy is recommended for patients with symptoms lasting longer than 3 months, myocardial abscess, or selected other complications	Penicillin G 20-30 million units i.v./day for 6 weeks or Ampicillin* 12 g i.v. in 6 equally divided doses/day for 6 weeks with Gentamicin 1 mg/kg/ i.m. or i.v. (single dose of 80 mg) q 8 hours for 6 weeks.	
Methicillin-susceptible staphylococci	Cloxacillin 2 g i.v. q 4 hour for 4-6 weeks with or without Gentamicin 1 mg/kg/i.m. or i.v. (single dose ≤ 80 mg) q 8 hour for 3-5 days of therapy	In the few patients infected with a Pencillin susceptible *Staphylococcus*, Penicillin G may be used instead of Cloxacillin	Cloxacillin 2 g i.v. q 4 hour for ≥6 weeks with Rifampicin 300 mg orally q 8 hour for ≥6 weeks with Gentamicin 1mg/kgi.m. or i.v. (single dose ≤80 mg) q 8 hour for 2 weeks	Wise to delay initiation of Rifampicin for 1 or 2 days, until therapy with two other effective antistaphylococcal drugs has been initiated
Methicillin-resistant staphylococci	Vancomycin 30 mg/kg/day i.v. (total dose ≤2g/day) for 4-6 weeks with or without Gentamicin 1 mg/kg i.m. or i.v. (single dose ≤80 mg) q 8 hour for first 3-5 days of therapy		Vancomycin 30 mg/kg/day i.v. (total dose ≤2 g/day) for ≥6 weeks with Rifampicin 300 mg orally q 8 hour for ≥6 weeks and Gentamicin 1 mg/kg/i.m. or i.v. (single dose ≤80 mg) q 8 hour for 2 weeks	*Staphylococcus,* resistant to Gentamicin, an alternative third agent should be chosen on the basis of *in vitro* susceptibility testing
Right-sided staphylococcal NVE in selected patients	Cloxacillin 2 g i.v. q 4 hour for 2 weeks with Gentamicin 1 mg/kg/i.m. or i.v. (single dose <80 mg) q 8 hour for 2 weeks	Exclusions to short course therapy include any associated cardiac or extracardiac complications, persistence of fever for ≥7 days, infection with HIV and probably patients with vegetations greater that 1-2 cm according to echocardiography		
HACEK organisms	Ampicillin 2 g i.v. q 4 hour or Ceftriaxone 1 g i.v. q 12 hour for 4 weeks with Gentamicin 1 mg/kg i.v. q 8 hour (peak serum level 4-6 μg/ml) for 4 weeks		Ampicillin 2 g i.v. q 4 hour or ceftriaxone 1 g i.v. q 12 hour for >6 weeks with Gentamicin 1 mg/kg i.v. q 8 hour (peak serum level 4-6 μg/ml) for ≥6 weeks	
Gram-negative bacilli (some examples) *Pseudomonas*	Piperacillin (3 g i.v. q 4 hour), Ceftazidime (2 g i.v. q 8 hour) or Imipenem (0.5–1 g i.v. q 6 hour) and Tobramycin 1.7 mg/kg q 8 hour for 6 weeks	Further changes according to antimicrobial susceptibility. Always give the maximum permissible dose	Piperacillin (3 g i.v. q 4 hour), Ceftazidime (2g i.v. q 8 hour) or imipenem (0.5 – 1 g i.v. q 6 hour) and Tobramycin 1.7 mg /kg q 8 hour for 6 weeks	Further changes according to antimicrobial susceptibility. Always give the maximum permissible dose
Enterobacteriaceae	Cefotaxime (2 g i.v. q 4 hour) or Imipenem ((0.5–1 g i.v. q 6 hour) or Aztreonam (2 g i.v. q 6 hour) + Gentamicin 1mg/kg i.m. or i.v. q 8 hour		Cefotaxime (2 g i.v. q 4 hour) or Imipenem ((0.5 – 1 g IV q 6 hour) or Aztreonam (2 g i.v. q 6 hour) + Gentamicin 1mg /kg i.m. or i.v. q 8 hours	
Fungal	Amphotericin B 1mg/kg/day i.v. (total dose 2.0-2.5g) for 6-8 weeks with or without Flucytosine 150 mg/kg/day orally in 4 divided doses for 6-8 weeks		Amphotericin B 1 mg/kg/day i.v. (total dose 2.0 –2.5 g) for 6-8 weeks with or without Flucytosine 150 mg/kg/day orally in 4 divided doses for 6-8 weeks	
Culture-negative	Penicillin 20-30 million units i.v./day/Ampicillin 12 g i.v. in 6 equally divided doses/day or Vancomycin 30 mg/kg/day i.v. (total dose ≤2 g/day) and Gentamicin 1 mg/kg i.m. or i.v. (single dose ≤80 mg) q8 hours	This empirical therapy should be guided by clinical response. Duration of therapy is 4-6 weeks for NVE, 6-8 weeks for PVE. If fungal endocarditis is suspected, treat accordingly	Vancomycin 30 mg/kg/day i.v. (total dose ≤ 2g/d/day) + Gentamicin 1 mg/kg i.m. or i.v.(single dose ≤80 mg) q 8 hour + Ceftriaxone 1g i.v. q 12 hour/Cefotaxime 2g i.v. q 4 hour	If endocarditis 12 months after valve replacement, Ceftriaxone/Cefotaxime for 4-6 weeks for NVE and 6-8 weeks for PVE. If fungal endocarditis is suspected, treat accordingly

Adapted from Mylonakis E, Calderwood SB[6] and Bansal RC[15]
Note: Antibiotic doses should be modified appropriately in patients with renal or hepatic dysfunctions
HIV : Human immunodeficiency virus

CARDIAC COMPLICATIONS

Congestive heart failure is the most common cause of death and the most compelling indication for surgery in patients with endocarditis. The usual cause of heart failure in patients with endocarditis is valvular insufficiency caused by infection-induced valvular destruction. Fragments of valvular vegetations may occasionally embolize into the coronary arteries and cause acute myocardial infarction and subsequent heart failure. Patients with aortic valve endocarditis are at risk for *rapidly developing* progressive heart failure or pulmonary oedema and require emergency surgery. Congestive heart failure is less frequent in patients with mitral valve endocarditis.

Paravalvular abscesses occur in patients with PVE, more commonly in patients with mechanical PVE than with bioprosthetic valve endocarditis. In NVE, paravalvular abscesses are more likely to form fistulae or aneurysms in patients with mitral valve involvement than with the aortic valve. However, abscess formation is associated with death rates >75% unless surgical intervention is carried out.

NEUROLOGICAL COMPLICATIONS

Strokes following embolic events contribute significantly to mortality and long-term sequelae due to IE. The rate of embolic events decreases rapidly after the initiation of effective antibiotic therapy.

Intracranial mycotic aneurysms most commonly involve the middle cerebral arteries, especially distally. A mycotic aneurysm complicating endocarditis can present as stroke or subarachnoid haemorrhage. Some aneurysms leak slowly before rupture and produce headache and mild meningeal irritation in some patients, whereas in others there are no premonitory signs or symptoms before sudden intracranial haemorrhage.

EMBOLIC COMPLICATIONS

Systemic emboli, besides involving the central nervous system, most commonly involve the spleen, kidney, liver and the iliac or mesenteric arteries. Splenic as well as other metastatic abscesses can be a cause of prolonged fever, and splenomegaly may be absent.

RENAL COMPLICATIONS

Renal complications are particularly frequent in patients with IE due to *Staph.aureus*. They may manifest as haematoma, glomerulonephiutis or renal infarction, and are due to embolic and immune complex-mediated processes.

Treatment

ANTIMICROBIAL THERAPY

Successful therapy involves prolonged parenteral administration of bactericidal antimicrobial agent(s) with specific activity against the causative organism (Table 4). Delay in therapy can result in further valvular damage and abscess formation. However, if the patient is haemodynamically stable as in subacute endocarditis, it is safe to wait for 2-3 days or more to ensure adequate collection of blood for isolation of the causative organisms. Both minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC) of different possible antibiotics to the organism should be determined.

The causative organism should be retained for future studies and the need to revise therapy. After initiation of therapy, blood cultures should be repeated during the course of treatment till they are negative. If blood cultures are persistently positive, this may necessitate further action-changing the dose of the antibiotic, adding another antibiotic or changing it, or even considering surgery. Other laboratory tests, including complete blood count, serum creatinine and liver enzyme levels should also be carried out during the course of therapy.

SURGICAL THERAPY

Congestive heart failure is the strongest indication for surgery in.[6] Infection that is refractory to medical therapy, i.e. lack of improvement inspite of more than 1 week of antibiotics or lack of blood sterility within a week also needs surgical attention.[13] Surgery is also indicated if endocarditis is due to certain pathogens such as *Pseudomonas aeruginosa, Brucella* spp., *Coxiella burnetii, Candida* spp., other fungi and probably enterococci.

In PVE, if there is an early-onset, progressive infection, haemodynamic deterioration or a relapse after adequate medical therapy, then these cases need surgical evaluation. Antimicrobial treatment alone is indicated in late-onset PVE (>12 months after implantation of a prosthesis), infection by viridans streptococci, HACEK organisms or enterococci, with no evidence of perivalvular extension of infection.

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IMSA News

IMSA Chapter Activities (July to Sept 2004) :

Delhi Chapter

25.08.2004 : Lt. Col. Dr. A.K. Singhal, Dr. B.K. Dkaun *'Osteo Arthitis'.*

16.09.2004 : Dr. S.M. Kaul *'Malaria and Dengue'.*

24.09.2004 : Dr. Neeru Aggarwal *'Recurrent Urinary Tract Infection in Women'.*

: Dr. Ashok Kumar *'Basti Sevika as 'Ambassador of Health'.*

26.09.2004 : Dr. H.K. Chopra, Dr. I.P.S. Kalra *'Spirituality and Medicine'.*

Tamil Naidu Chapter

10.07.2004 : Dr. Bagyam Raghavan *'Imaging in Breast Disease - A Multimodality Appraoch'.*

08.08.2004 : Dr. Palanisamy *'Treatment of Heart Failure'.*

12.09.2004 : Dr. Manoharan *'Surgical Aspects of Tetrology of Fallots'.*

Election of Fellows / Members

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Dr. Gurpreet Sandhu	*USA*
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Fellows elected on 25-8-2004	
Dr. Parijat Chandra	*New Delhi*

IMSACON-2005

Venue : JAIPUR (Rajasthan) **Dates :** 23-10-2005 to 25-10-2005 **Theme :** EMERGING HEALTH CHALLENGES

Please send your papers to Dr. S. Panicker, Organising Secretary or Dr. I.P.S. Kalra, Secretary General, IMSA. Kindly keep these dates free for attending the **Conference** with your spouse and children. For details please contact:

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Obituary

Dr. Pratibha Ranjan Dutt born on March 25 1911 in Kolkata completed his MMBS in 1936 earning a Distinction in the field of Mid-wifery; he obtained his Diploma in Public Health from Calcutta in 1941. He began his service career with the Medical Corps of the Indian Army He joined the Directorate General of Health services in 1954 and retired as Deputy Director General Health Services (Public Health), Government of India in 1969. He was then with the NIHAE for two years; later joined the Grndhigram Institute of Health and Family Welfare as its Director and was on its Board of Trustees.

He became a fellow of the International Medical Sciences Academy in 1987. He has written several books in the field of Primary health Care and his last book was in three volumes in 1996 which he dedicated to the Gandhigram Institute of Health and Family Welfare in Tamil Nadu. Dr. P.R. Dutt dedicated his life to the Rural Health Services in India and was deeply concerned with the welfare of the rural women and children.