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Original Article

Evaluation of The Efficacy and Safety of Zostum (Combination of Cefoperazone and Sulbactam) followed by Zostum-O (Cefditoren) in Prevention of Surgical Infections

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Abstract

Aim : The purpose of the present study was to assess the efficacy of an empiric peri-operative prophylactic regimen in prevention of surgical site infections (SSI), using cefoperazone & sulbactam combination to be followed by oral switch over therapy with cefditoren.

Material and Methods: It was an open, non comparative, multicentric, post-marketing surveillance study of 190 patients from 95 surgical centers, spread across India, undergoing various types of emergency and elective surgeries. Patients were categorized according to the type of operative wound as "clean", "clean contaminated", "contaminated" and "dirty". They were evaluated according to the Southampton scoring system.

Result: The rate of SSI in general was 7.36%. The observed rate of SSI for patients with dirty wounds was 3.92% whereas it was 3.07%, 6.38% and 25.9% for clean, clean contaminated and contaminated wounds respectively. The global wound score got reduced from 12.89 on day 1 to 2.75 on day 8 ($p<0.01$).

Conclusion: This is the first study clearly providing the efficacy data to reduce the incidence of SSI with the peri-operative antibiotic regimen of 'Zostum', consisting of cefoperazone & Sulbactam for an average duration of 5 days followed by switch over to oral antibiotic prophylaxis with 'Zostum O', containing cefditoren. The result of the present study shows a superior outcome as compared to earlier studies in peri-operative prophylaxis conducted with single cephalosporins. In conclusion, this regimen is highly effective and can be adapted for wide varieties of surgeries.

Introduction

Surgical site infections (SSIs) are the second most common cause of nosocomial infections and they account for approximately a quarter of all nosocomial infections[1,2]. They remain a major source of post-operative morbidity. Up to 2% to 5% of patients undergoing clean extra-abdominal operations and up to 20% undergoing intra-abdominal operations are reported to develop an SSI[3]. Overall Surgical site infection rate has varied from a low of 2.5% to a high of 41.9%[4].

The Centers for Disease Control and Prevention (CDC), estimates that approximately 500,000 SSIs occur annually in the United States[5]. The reported incidence of SSI in India has ranged between 4.04 to 30% for clean surgeries and 10.06 to 45% for clean-contaminated surgeries[6,7]. Patients who develop SSIs are up to 60% more likely to spend time in an intensive care unit, five times more likely to be readmitted to the hospital, and to have twice the mortality rate compared with patients without an SSI[8]. Health care costs are substantially increased in patients who develop SSIs as well as bed occupancy is also a significant factor[1-5,8].

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Nosocomial infections are the most frequent complications observed in surgical patients. In recent years, reductions of postoperative infections have been mostly due to a correct use of a prophylactic measures such as preoperative selective bowel decontamination, adequate antibiotic prophylaxis and better anaesthetic and intensive care management. Research has shown that surgical techniques, skin preparation and the timing and method of wound closure are significant factors that can influence the incidence of subsequent infection. Antibiotic prophylaxis has also had a positive impact after certain types of surgery[9]. For most major procedures, the use of prophylactic antibiotics has been demonstrated to reduce the incidence of surgical site infections significantly. For example, antibiotic prophylaxis in colorectal surgery reduces the incidence of surgical site infection from 25–50% to below 20%. In addition, in a case control study of Medicare beneficiaries, the use of preoperative antibiotics within 2 hours of surgery was associated with a two-fold reduction in 60-day mortality. Prophylactic antibiotics are considered standard care for all but clean surgical procedures[10].

Most surgical site infections are acquired intra-operatively and are endogenous, arising from the flora of the patient's skin, gastrointestinal tract or mucous membranes. Exogenous infections are less common and are probably acquired from the skin or nasal flora of the operating team, or more rarely from contaminated material of instruments in the operating theatre[11].

During these last few years, different studies reported in the literature proposed guidelines for an appropriate use of antibiotic prophylaxis .The aim of antibiotic prophylaxis is not the sterilization of the clinical field, but rather to facilitate the function of the host immune defense mechanisms by decreasing/ suppressing bacterial growth in the surgical site[12]. Antibiotic prophylaxis must be applied rationally. The choice of the antibiotic to use for the prophylaxis is based on the microorganisms usually found in the surgical site, and on the specific hospital microbiologic epidemiology. Other factors relevant in the evaluation of an antibiotic to use for prophylaxis are the drug pharmacokinetics, its distribution in the tissue and lastly, its cost[13].

The route of administration, as well as the time and dose of the antibiotic, are crucial. The route of administration may be oral and/or parenteral. Currently, while there is a general consensus on the indication of the utilization of prophylactic antibiotics intravenously, worldwide[14,15], some surgeons, mainly in North America, prefer administering antibiotic prophylaxis both systemically and orally[16]. The results of the use of both these routes (systemic plus oral) for antibiotic prophylaxis are heterogeneous: some authors demonstrate a significant advantage using this combination[17,18], while others did not observe better results[19]. Surgical antibiotic prophylaxis (SAP) has been shown to be effective in reducing the incidence of surgical wound infections for many types of surgery.

Cephalosporins have emerged as the drug of choice for perioperative prophylaxis because of their (wide) antibacterial spectrum. They cover gram positive as well as gram negative organisms effectively, low incidence of allergy and side effects as well as they are cost effective. (Kaiser, 1990)[20].

Organisms which are encountered in surgical site infection are *Staphylococcus aureus, Pseudomonas aerugenosa, Acinetobacter baummanii, Klebsiella pneumoniae*, Enterobacter species, Bacteroides fragilis group are commonly found organisms in surgical site infection. Other organisms are: Coagulase negative Staphylococci, Streptococcus pyogenus, Streptococcus group, Microaerobic streptococci, Enterococcus faecalis, Proteus species, morganella, providencia, Escherichia coli, Candida spp., Prevotella and Porphyromonas spp., Fusobacterium spp., Clostridium spp., Peptostreptococcus and non-spore forming anaerobic, gram positive rods[21].

With the extensive use of third and fourth generation cephalosporins as an important component of empirical therapy in intensive care units and high risk wards, resistance to these drugs has become a major problem all over the world. Resistance has developed in bacteria by possessing extended spectrum beta-lactamases (ESBLs) capable of hydrolyzing these newer cephalosporins. Beta-lactamase mediated resistance may be overcome by combining beta-lactam antibiotics with beta-lactamase inhibitors which bind irreversibly to the beta-lactamases and render them inactive thus sparing the beta-lactam antibiotic[22].

Cefoperazone is a parenteral, third generation antibiotic with broad antibacterial spectrum, covering Gram-positive, Gram-negative and anaerobic organisms, also it is resistant to degradation by many beta-lactamases that make Cefoperazone suitable for prophylaxis as well as treatment

of Surgical Site Infection. Additionally, Cefoperazone has a superior action against Pseudomonas spp. when compared to many other cephalosporins, Cefoperazone has been found to be effective in a wide variety of infections at most sites in the body, including those in immunocompromised patients. The high biliary concentrations of Cefoperazone make it particularly effective in infections of the biliary tract and for prophylaxis in biliary surgery. Sulbactam irreversibly inhibits the hydrolytic activity of beta-lactamases, thus in this combination the activity of cefoperazone against beta-lactamase-producing bacteria is restored. One of the particular advantages of using Sulbactam-containing combinations is that Sulbactam itself has inherent activity against Acinetobacter baumanii spp[23]. Among all ß -lactam inhibitor combinations tested cefoperazone/ Sulbactam revealed the highest activity against ß -lactamases producing organisms. Its superior activity is attributed to the improved stability of cefoperazone and to the high concentration of the inhibitor component (Sulbactam) so the combination works much better then using the cefoperazone alone[24].

The purpose of the present study was to assess the efficacy of cefoperazone / Sulbactam combination in perioperative prevention of infection followed by oral switch over to cefditoren in surgical site infections.

Material and Methods

The study was conducted as an open, non comparative, multicentric, non randomized post marketing surveillance study to evaluate the efficacy of Intravenous fixed dose combination of cefoperazone and Sulbactam followed by oral therapy with cefditoren in perioperative prevention of surgical site infections.

The study was spread all over India and conducted during July 2007 to February 2008. A total of **95 surgeons** and **190 patients (126 male and 64 female)** were involved in the study. Majority of the patients were in the age range of 18-40 years (n=79) and 40-60years (n=74). Among the remaining patients 16 were less than 18 years while 21 were more than 60 years old.

All the patients undergoing either 'elective' or 'emergency' surgery or who have given written informed consent to participate in the trial were included in the study. Patients having history of hypersensitivity to penicillin/ cephalosporin group of antibiotics were not included. Other exclusion criteria were active infection requiring treatment before or at the time of surgery, patients with concomitant disease for which surgery has been cancelled or postponed, death during the study period and deviation from the trial protocol such as incorrect antibiotic administration.

Zostum brand of cefoperazone sodium/ Sulbactam combination was provided by **ZUVENTUS HEALTH CARE LTD.** in strength of 1gm injection, as a dry powder for injection to be used after reconstitution with sterile water (provided along with the antibiotic). **Zostum O** (cefditoren) was provided as 200mg capsules for oral administration. Zostum was administered intravenously to the patients before surgery and continued as per the individual requirement, and a switch over to the oral antibiotic was done when the patient was fit to consume the oral medication.

Study procedure

The vital statistics of the patients and the surgical wound condition was closely monitored from day 1 to day 8.

The classification of operative wounds was based on degree of microbial contamination and were categorized as shown in **Table 1**.

Table 1

Classification	Criteria
Clean	Elective, not emergency, non-traumatic, primarily closed; no acute inflammation; no break in technique; respiratory, gastro-intestinal, biliary and genitourinary tracts not entered.
Clean-contaminated	Urgent or emergency case that is otherwise clean; elective opening of respiratory, gastrointestinal, biliary or genitourinary tract with minimal spillage (e.g. appendicectomy) not encountering infected urine or bile; minor technique break.
Contaminated	Non-purulent inflammation; gross spillage from gastrointestinal tract; entry into biliary or genitourinary tract in the presence of infected bile or urine; major break in technique; penetrating trauma <4 hours old; chronic open wounds to be grafted or covered.
Dirty	Purulent inflammation (e.g. abscess); preoperative perforation of respiratory, gastrointestinal, biliary or genitourinary tract; penetrating trauma >4 hours old.

Table 2

Grade	Appearance		Score
0	Normal healing		0
I	Normal healing with mild bruising or erythema:		
	A	Some bruising	1
	B	Considerable bruising	2
	C	Mild erythema	3
II	Erythema plus other signs of inflammation		
	A	At one point	4
	B	Around sutures	5
	C	Along wound	6
	D	Around wound	7
III	Clear or haemoserous discharge:		
	A	At one point only (<2cm)	8
	B	Along wound (>2cm)	9
	C	Large volume	10
	D	Prolonged (>3 days)	11
Major complication			
IV	Pus:		
	A	At one point only (<2cm)	12
	B	Along wound (>2cm)	13
V	Deep or severe wound infection with or without tissue breakdown; haematoma requiring aspiration		14

The surgical wounds were graded based upon the Southampton wound scoring system as shown in **Table 2**. (Adapted from Bailey IS *et al*, BMJ 1992 21)

Southampton scoring system

Surgeons' observations for any other relevant finding were recorded. Pain intensity score based upon the visual analogue scale and daily record of antibiotic administration was maintained. The day of switch over from parenteral to oral therapy was also recorded.

Statistical Analysis

Statistical methods: The various observations were compared on day 1 and day 8 using Student's 't' test.

Demography of operative wound:

There were 65 patients with clean wound, 47 patients with clean and contaminated wound, 27 patients with contaminated and 51 patients with dirty wounds. Patients undergoing various types of emergency and planned surgeries like appendicectomy, cholecystectomy, hysterectomy, hernioplasty, wound debridement, prostectomy, exploratory laparotomy, incision and drainage of abscess, amputation of gangrenous diabetic foot, Gastro jejunostomy, excision and removal of glioblastoma and total knee replacement were included in the study.

Results

There were no statistically significant differences found in vital statistics for blood pressure, pulse or respiratory rate. The **mean temperature** of the patient was 99.7+/- 1.69 on the day 1 and 98.1+/- 0.68 on the day 8 (P<0.05).

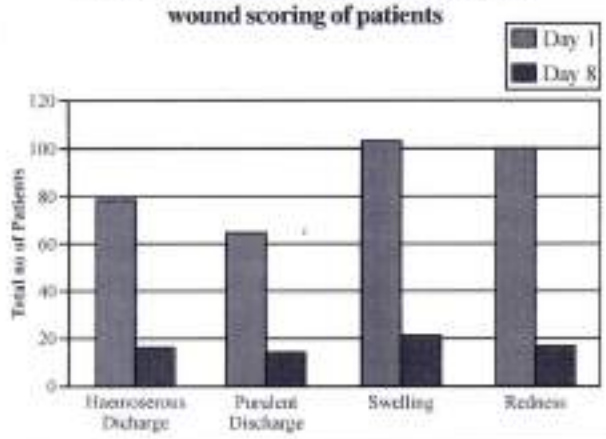
Dose of Zostum and Zostum O

157 patients received 1gm dose on the 1st day, whereas 29 patients received 2gm dose on day1 with a mean duration of 5 days. A switch over to oral cefditoren (Zostum-O) was commenced after a mean duration of 5 days of intravenous cefoperazone Sulbactam combination. The graphical representation of the results is given in **Fig. 1**.

Haemoserous discharge: On day 1, a total of 85 patients (45%) showed haemoserous discharge. The discharge reduced from <2cm to nil, in 91.9% of patients on day 8 (P <.05). 100%of patients with discharge >2cm on 1st day recovered to nil discharge on day 8 (p<.05). 72% of patients had discharge reduced from large volume to nil whereas 25% of patients showed reduction from large volume to <2cm at day 8. Only a small percentage of patients (3%) had their haemoserous discharge reduced from large volume to >2cm (p< 0.05). 'Prolonged discharge' was observed in 6 patients (3%) and 5 out of them recovered at the end of study observation i.e. day 8.

Purulent discharge as per Southampton score is classified as major complication of grade IV and it is subdivided into two categories i.e. category 'A' with pus discharge at one pt only (<2cm) and category 'B' with pus discharge along wound (>2cm). A total of 34% patients had purulent discharge on day one with 14% having category 'A' and 20% category 'B' of grade IV complication. Out of category 'A' all the patients got the purulent discharge

Fig. 1
Effect of Zostum therapy on Southampton wound scoring of patients



reduced from <2 cm to nil (p <0.001) whereas 81.9% patients from category 'B' recovered to nil discharge (P<0.001).

Swelling of the wound: 54.2% of the total patients had developed swelling on day 1. Out of which 100% of patients with swelling at one point, 89% (P< 0.05) with swelling around sutures, 83.7% (P<0.001) with swelling along the wound and 84.1% (P<0.05) with swelling around the wound had it reduced to nil by the end of the day 8.

Redness of surrounding area: 52.6% patients had bruising or 'erythema' on day 1 (grade I C). 89.2% of patients with 'some bruising' (grade I A) recovered fully (P=.001). Among patients with 'considerable bruising' (grade I B) 90.7 % were completely relieved (P<.05). 86.7% with mild erythema on day 1 had no redness at the end of 8th day.

Global Wound Score

Global score was calculated by giving value to the recorded severity to each subgrade based upon Southampton scoring and a value from 1 to 14 was given as shown in **Table 2**.

The global average symptom score was reduced from 12.89 on day 1 to 2.75 on day 8 which is statistically significant (p<0.05). **Table 3** shows the improvement in the individual global scores based upon the four wound categories.

The investigator's Assessment:

Investigator's assessment for the outcome of the therapy was given a score for efficacy of the treatment as shown in **Table 4**:

Table 3

Wound category		Day 1	Day 8	P value
Clean	(n=65)	10.81	3.72	<0.01
Clean contaminated	(n=47)	8.36	2.31	<.05
Contaminated	(n=27)	21.03	6.48	<0.01
Dirty	(n=51)	22.19	2.25	<.05

Table 4

Investigator's Assessment	Score
Unsatisfactory	1
Satisfactory	2
Fair	3
Good	4
Excellent	5

Investigator's mean assessment score was 4.05 out of 5 (P<.05) at the end of the treatment depicting a high level of satisfaction with the usage of current regimen.

Discussion

The evidence for effectiveness of perioperative antibiotic prophylaxis is well established[25]. The efficacy of many antibiotics including various cephalosporins in perisurgical management of wound infections have been studied in various clinical trials.

According to the CDC definition only infections occurring within 30 days of surgery (or within a year in the case of implants) should be classified as surgical site infections (SSI)[26]. Wound infection has also been defined in a number of ways. In some surveys the definition of wound infection was based on a simple, easily observable character such as presence of pus in the wound. However, a more complex and comprehensive definition, making use of several other signs of inflammation (e.g. erythema) has been used with an elaborate scoring system. Needless to say the recorded incidence of infection will also depend on the length of postoperative stay and the degree of follow-up after discharge from hospital.

According to Southampton wound scoring system all the wounds having a pus discharge either at one point only (<2cm) or along wound (>2cm) are regarded as infected wound[27].

A study conducted by Lilani SP *et al* gives a clear picture of surgical site infection of upto 40% in cases of dirty wound, inspite of the antibiotic prophylaxis[4]. In the current study it was found that the rate of SSI in dirty wound was only 3.92%. This difference shows the potential of cefoperazone & Sulbactam combination in the prevention of surgical site infection. Another study conducted in Brazilian population reported the SSI incidence in dirty wounds to be 20.7 %[28]. In Mexico, the SSI infection rates for dirty procedures were 32.4%[29]. The SSI rate varied from 16.6% to 19.6% in the studies done in Thai population, another Asian developing country[30,31] and 16.7% in one of the studies from the Soviet Union[32].

In the present study the rate of SSI for overall patients including all the categories was 7.36%. The rate of SSI for patients with clean wounds was 3.07%; for those with clean contaminated wound the rate was 6.38%; those with contaminated and dirty wounds the rates were 25.9% and 3.92% respectively, which was superior to the overall infection rate of 8.95% reported in one of the other clinical study done in Indian population. Surgical site infection rate was found to be 3.03% in clean surgeries and 22.41% in clean-contaminated surgeries in the same study[4]. The overall infection rate in India ranges from 2.5 % to 41.9% with 1-2 % in clean cases, 10 % or less in clean contaminated cases, 15- 20% in contaminated cases and less than 40% in dirty cases[33]. The results of present study were also favourably comparable, in some cases superior, with many of the past international studies establishing the surgical site infection rate in the four wound categories.

The overall wound condition can be judged from the global wound score. A significant improvement in the global score of the patients in each wound category was observed in the present study. The reduction of global score from day 1 to day 8 in patients with clean surgeries was from 10.81 to 3.72 (p=<0.001), in clean contaminated surgeries it reduced from 8.36 to 2.31 (p=<0.001), in 'contaminated surgeries' the reduction was from 21.03 to 6.48 (p=<0.001) and in the 'dirty surgeries' from 22.19 to 2.25 (p=<0.001). These results provide a definite proof of high efficiency of Cefoperazone & Sulbactam combination followed by Cefditoren oral treatment. Evidence from a number of clinical studies suggests that single-agent therapy with β-lactam/β-lactamase inhibitor combination is suitable for use in perioperative prophylaxis and may offer benefits over other agents in terms of reduced incidence of surgical wound infections and lower costs[34]. The results of the present study support the same view when we compare the overall wound infection rate observed in this study (7.36%) with that of single antibiotic as seen in Ceftriaxone 8% and 12% of Cefotaxime reported in literature[35]. This is further justified by Investigator's mean assessment score of 4.05 out of 5 at the end of the treatment regimen depicting a high level of satisfaction with the usage of current regimen

The pathogens isolated from infections differ, primarily depending on the type of surgical procedure. In clean surgical procedures, in which the gastrointestinal, gynaecologic, and respiratory tracts have not been entered, *Staphylococcus aureus* from the exogenous environment or the patient's skin flora is the usual cause of infection. In other categories of surgical procedures, including clean-contaminated, contaminated, and dirty, the polymicrobial aerobic and anaerobic flora closely resembling the normal endogenous microflora of the surgically resected organ are the most frequently isolated pathogens.

According to data from the National Nosocomial Infections Surveillance System (NNIS), there has been little change in the incidence and distribution of the pathogens isolated from infections during the last decade. However, more of these pathogens show antimicrobial-drug resistance, especially methicillin-resistant *S. aureus*. *Pseudomonas aerugenosa*, Acinetobacter baumanii, Klebsiella pneumonia, Enterobacter species are commonly found organisms in surgical site infection.

Cefoperazone combination has been found to be effective in most of the above infective organisms[36]. Cefditoren also has a broad spectrum of activity against many gram-negative and gram-positive aerobes, including Streptococcus pneumoniae, Staphylococcus aureus, Streptococcus pyogenes, Haemophilus influenzae, and Moraxella spp. Thus it is also very effective in patients with SSI[37].

Profiles and mechanisms of resistance to beta-lactam antibiotics of isolates of Gram-negative microorganisms, which are causative agents of infections in Intensive Care Unit of hospital surgery department, were studied, in one

of the studies. Two hundred and ten clinical isolates were studied: *Pseudomonas aeruginosa*-86 strains (40.9%), Acinetobacter baumanii-45 strains (21.4%), Klebsiella pneumoniae-52 strains (24.8%), Escherichia coli-23 strains (11%), Enterobacter spp.-4 strains (1.9%). Carbapenems and **cefoperazone/Sulbactam** were found to be the most active antibiotics[35].

Antimicrobial resistance surveillance study was performed in 100 medical centers for susceptibility testing of 9152 strains including Escherichia coli, Klebsiella spp, Enterobacter spp., Acinetobacter spp., *Pseudomonas aeruginosa*, Staphylococcus aureus, with 7 beta-lactams, including cefoperazone/Sulbactam. Acinetobacter spp. strains were least resistant to **cefoperazone/Sulbactam** (0.7% resistance), Imipenem (2.6%), Cefepime (6.6%), and Ceftazidime (7.7%) compared with other beta-lactam antibiotics tested. Isolates of *P. aeruginosa* were more susceptible to **cefoperazone/Sulbactam** (9.8%). It was also established that beta lactamase combined 3rd generation cephalosporins are the most active agents against E. coli[36].

There are no previous studies available in perioperative prophylaxis with cefoperazone & combination followed by oral cefditoren regimen. The result of the present study shows a superior outcome as compared to earlier studies in perioperative prophylaxis conducted with single cephalosporins. The cost effectiveness is also justified by reduction in the duration of hospitalization required. This is the first such study clearly providing the efficacy and safety data for the regimen. In conclusion, perioperative antibiotic cover of 'Zostum', consisting of cefoperazone & Sulbactam for an average duration of administration of 5 days followed by switching over to oral prophylaxis with capsule 'Zostum O', containing cefditoren is a highly effective and well tolerated regimen, which can be adapted for a wide varieties of surgeries.

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Andhra Pradesh : Dr. Bramhanandan; Dr. D.S. Venkata S. Reddy; Dr. E.V.P. Nandan; Dr. G.S. Rao; Dr. Imtiaz Ahmed; Dr. J. Surendra; Dr. K. Bala Durga Rao; Dr. K. Pattabhi Ramajah; Dr. M. Ranganathan Babu; Dr. R.B; Dr. R. Satyanarayana; Dr. T. Venkateswara Rao; Dr. V. Rama Mohan Rao; Dr. Y. Satyanarayana; Dr. Yogesh Mehta. **Assam :** Dr. P. Deori. **Bihar :** Dr. Madhur Kumar Verma; Dr. Vinod Kr. Pandey. **Delhi :** Dr. Ajit U. Deshmukh; Dr. Asish Gupta; Dr. Atul Sardana; Dr. Jitender Kumar; Dr. Kuldeep Raj; Dr. N.G. Grover; Dr. Naveen Jain; Dr. Satish Tyagi. **Karnataka :** Dr. B.M. Mahesh; Dr. H.C. Gopal Swamy; Dr. K.A. Shivaramaian; Dr. Majunath Reddy; Dr. Ramalingaiah A.; Dr. Ramesh D. K.; Dr. Ramshankar; Dr. Sachin; Dr. Sridhar; Dr. T.H. Anjanappa; Dr. T.R. Radhakrishna. **Maharashtra :** Dr. Abhoy Kumar Sinha; Dr. Bhupesh Paradkar; Dr. Dinesh Kadam; Dr. I. Nikam; Dr. Ishtraq M. Shekhani; Dr. J. A. Jafri; Dr. J.A. Kaddu; Dr. J. G. Raut; Dr. J. K. Chokshi; Dr. Mahesh B. Doshi; Dr. P. Gandhi; Dr. P.N. Katakwar; Dr. Pawan L. Shahane; Dr. Pokale Ajit Dattatraya; Dr. Praveen Gupta; Dr. Rajesh Singhania; Dr. Rajesh Turekar; Dr. Ravindra Patel; Dr. Sarang Alaspurkar; Dr. Sarang Karandikar; Dr. Satish Kamat; Dr. Shivish Kumar N. Shinde; Dr. Vijay G. Patel; Dr. Vilas J. Patil. **Rajasthan :** Dr. Anil Gupta; Dr. Satish Mathur; Dr. Sudhir Gupta; Dr. Vijaypal Singh. **Tamil Nadu :** Dr. A. Vijaya Varma; Dr. C. Selvakumar; Dr. D. Prabakar; Dr. O. Chandrakanth; Dr. Winston Noronha. **West Bengal :** Dr. Abhishek Chakraborty; Dr. Alok Pal; Dr. Amitava Sett; Dr. Asis Kumar Basak; Dr. Asis Kumar Sinha; Dr. Aswini Pathak; Dr. Bimal Kr. Chatterjee; Dr. Dipankar Roy; Dr. Jaganath Das; Dr. Jagannath Mandal; Dr. Joydeep Banerjee Chowdary; Dr. K. Kumar Ray; Dr. M.A. Quader; Dr. Mainul Hassan; Dr. Manoj Kumar Agarwal; Dr. Nupur Dutta; Dr. Pallab Ghosh; Dr. Prasenjit Pal; Dr. Ranjit Dutta; Dr. Rupak Kumar Dutta; Dr. S.N. Changdar; Dr. Samir Kr. Ray; Dr. Saradindu Ghosh; Dr. Syamal Sarkar; Dr. Timir Baran Das; Dr. Udipta Roy.

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