

## ***SALMONELLA SENFTENBERG:* EPIDEMICS IN INDIA AND PRESENT STATUS**

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*Salmonella enterica* serovar Senftenberg (*Salmonella senftenberg*: 1,3,19:g,[s],t:-) was first isolated by Kauffmann in 1928 from the stool of an 8 years old male child with acute gastroenteritis, at Senftenberg Hospital, Berlin, Germany(1). Since then, this organism has been reported in more than 30 countries with most isolations from the Netherlands, England, Germany, USA, Australia, India, Israel and Japan(2). *S. senftenberg* caused a major outbreak in

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UK, in 1976, involving 3,500 school children, teachers and cooks, several of whom developed gastroenteritis(3).

*S. senftenberg* was isolated for the first time in India from sewage samples in 1963. These samples were taken from 14 different places in Mathura city and neighbouring villages(4). Recently, its increasing rate of isolation from human sources, especially from infants and neonates in hospital environments has made it an important pathogen. This review brings out an up-to-date status of *S. senftenberg* in India from 1969 to 1993.

### **Epidemics**

The first outbreak due to *S. senftenberg* was reported in the pediatric ward and nursery of Mahatma Gandhi Institute of Medical Sciences, Sewagram and involved 7 patients and 7 asymptomatic carriers. The brunt was borne by newborns who developed septicemia and meningitis. The mortality was high. Ward was fumigated and temporarily closed to curb the infection. During the survey of nursery, *S. senftenberg* was isolated from intravenous stand, switch board and electrical extension board. All the isolates of *S. senftenberg* from these cases were multidrug resistant. These isolates were sensitive to cephaloridine, cephalexin, polymyxin B, furoxone and nalidixic acid(5). Four and nine months after the apparent control of this outbreak, 2 more sporadic cases were reported in neonates(6).

Two cases of neonatal septicemia due to *S. senftenberg* were reported from Patiala 1989, one of whom expired. *S. senftenberg* from both these cases were multidrug resistant(7). Another outbreak due to this organism was described in 1989 from the newborn nurseries of Safdarjang Hospital, New

Delhi. The serovar was recovered from 35 neonates with diarrhea. Multiple drug resistance was observed in 91.2% of the isolates(8). All the neonates showed good response to a combination of cephloridine and amikacin. Five neonates died in this outbreak(9).

*S. senftenberg* outbreak in a neonatal ward of Nehru Hospital, Postgraduate Institute of Medical Education and Research, Chandigarh involved 26 babies (22 neonates and 4 infants). It had 19.2% mortality. The epidemic reappeared after a gap of 4 months(10). The most recent outbreak involved 5 neonates, with septicemia, of which one died(11).

### Present Status

National Salmonella and Escherichia Centre (NSEC), Central Research Institute, Kasauli, receives *Salmonella* strains from different parts of the country for final identification and serotyping. This collaboration is voluntary and not all hospitals/institutes send their cultures to NSEC. The data presented here, therefore, may not truly reflect the actual incidence of *Salmonella senftenberg* in each region.

A total of 571, *S. senftenberg* strains were received at the Centre during 1969 to 1993. Out of these 488 (78%) were from human sources, 37 (6.5%) from animal sources and 86 (15%) were from other sources. Animal sources included poultry, fish, hippopotamus and sheep. Other sources included sewage, milk, meat and meat products and water. Serotyping was done using the antisera produced at NSEC, CRI, Kasauli.

Upto 1983, *S. senftenberg* remained as one of the rarely isolated serotype, but in 1984 and 1985 its isolation increased con-

siderably. In these two years, a total of 131 (4.4%) *S. senftenberg* strains were received at this Centre out of a total of 3001 salmonellae. This organism was placed fourth among the most common serotypes(12).

In 1986-89 *S. senftenberg* was ranked fifth among the most prevalent serovars and third most common amongst the isolates from human sources. During these years out of 5686 salmonellae received at NSEC, 225 (4%) were *S. senftenberg*(13).

During 1990-93 the incidence of this organism decreased further and only 120 (2.4%) were *S. senftenberg* out of a total of 5034 salmonellae received at the Centre.

Geographical distribution of *S. senftenberg* strains with respect to total salmonellae from different states/UTs during 1984-93 is shown in *Table I*. It is very clear that the incidence of this organism in Maharashtra and Punjab has decreased considerably but in Tamil Nadu and Uttar Pradesh its isolations are on rise. It is quite alarming that during 1990-93, 21.6% of *S. senftenberg* strains were isolated from West Bengal although otherwise it was a minor contributor with only 1.09% salmonellae. The condition is not much better in Delhi and UP where percentage of total salmonellae referred to NSEC is quite low as compared to percentage of *S. senftenberg* strains.

Source-wise distribution during 1984-93 is given in *Table II* which shows that human beings are the main source of isolation and 86% of the strains were isolated from humans.

Only few hospitals/institutes have given the age-wise details of the patients from whom salmonellae were isolated. But as

**TABLE I**—Statewise Comparative Distribution of *Salmonella senftenberg* in India During 1984-1993.

States	1984-85		1986-89		1990-93	
	1	2	1	2	1	2
Maharashtra	21	49	26	14	54	20
Tamil Nadu	21	—	15	4	13	21
Karnataka	9	—	3	—	7	—
Delhi	3	5	7	35	4	18
Gujarat	—*	—	—*	—	3	—
Punjab	4	30	11	23	3	—
Haryana	3	—	—*	—	3	—
Rajasthan	—*	—	—*	—	2	—
Uttar Pradesh	4	6	3	10	2	17
Goa	10	—	3	—	2	2
Himachal Pradesh	19	4	13	3	—*	—
Kerala	—*	—	6	1	—*	—
Pondicherry	—*	—	5	—	—*	—
Others	6	6	8	10	7	22

\* included in others.

1 = Percentage of total salmonellae referred to NSEC.

2 = Percentage of *Salmonella senftenberg* strains.**TABLE II**—Source-wise Distribution of *S. senftenberg* Strains in India During 1984-93.

Year	Source			Total
	Humans	Animals	Others	
1984-85	103	—	28	131
1986-89	206	7	12	225
1990-93	100	16	4	120
Total	409	23	44	476
Percentage	86	5	9	100

most of the workers, who have published *S. senftenberg* epidemics in India got their strains serotyped at NSEC and from these publications it can be inferred that *S. senftenberg* mainly causes nosocomial infection in neonates and infants.

### Conclusion

It is evident from these accounts that *S. senftenberg* remained a rarely isolated serotype before 1983 but after that emerged as an important pathogen in neonates in India. Besides neonates and infants, *S. senftenberg* has also caused infection

among children, adults(14) and immunocompromized patients(15). Asymptomatic carriers of this organism have also been described(5,16).

The main source of infection for *S. senftenberg* is man but this organism has also been isolated from various other sources like bone meal, drain abattoir, duck, goat, lizard, meat and meat products, mouse and poultry(17-23).

Multidrug resistance in this serovar have been described by a number of workers(5,7,8,14,24). Transferable drug resistance has also been reported in *S. senftenberg* isolates from blood samples of the patients clinically diagnosed to have enteric fever(25). This serovar produces enterotoxin, aerobactin and hemolysin(26-28). *S. senftenberg* seems to survive well in the environment and has been reported to withstand temperatures upto 70°C(29).

Epidemics due to multidrug resistant *S. senftenberg* strains in neonatal units pose a danger because of its extraintestinal manifestations. Its nature of being difficult to eradicate from the wards has further complicated the problem. Thus, there is a need for greater awareness about this neonatal, nosocomial, multidrug resistant pathogen and the time honored practice of antibiotic control, strict hygiene and aseptic precautions in the nurseries will be effective in preventing any further outbreaks.

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