

Leveraging the National Rotavirus Surveillance Network for Monitoring Intussusception

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Objective: To assess feasibility of monitoring intussusception by hospitals participating in the National Rotavirus Surveillance Network.

Methods: Questionnaire-based survey in 28 hospitals. One hospital with electronic records selected for detailed data analysis.

Results: There was 75% response to the questionnaire. Few network hospitals were suitable for monitoring intussusception in addition to ongoing activities, but there was at least one potential sentinel hospital in each region. The hospital selected for detailed data analysis of cases of intussusception reported an incidence rate of 112 per 100,000 child years in infants. Over 90% of intussusceptions were managed without surgery.

Conclusions: Selection of sentinel hospitals for intussusception surveillance is feasible and necessary, but will require training, increased awareness and referral.

Keywords: Complications, Rotavirus vaccine, Vaccine safety.

Intussusception is a common emergency in young children and has a peak incidence in infants aged between 5 and 7 months [1]. Diagnosis is confirmed by ultrasonography, and it is treated by air enema or hydrostatic reduction enema. Surgery is required only if the pneumatic or hydrostatic reduction is unsuccessful. This condition is also recognized as a rare complication of rotavirus vaccine, occurring usually 3-7 days after the first dose in 1 in 20,000 to 1 in 50,000 vaccine recipients [2-4].

The risk of intussusception with the Indian vaccine, Rotavac, is unknown [5]. The Rotavac vaccine has been introduced into the National immunization program of India in four states from 2016. In preparation for the introduction, the Indian Council for Medical Research (ICMR), which has been conducting surveillance for rotavirus disease [6,7], is planning to develop a safety and impact monitoring system.

The objective of this survey was to describe the capacity at hospitals participating in the ICMR's National Rotavirus Surveillance Network (NRSN)—which were originally selected to enroll children admitted with acute gastroenteritis to estimate the proportion of rotavirus positive cases—to conduct surveillance for intussusception. We also used available data to estimate the incidence of intussusception in children in infancy and up to 10 years of age.

METHODS

The 28 hospitals participating in the NRSN were sent a questionnaire that included information on hospital location, size, type of facility, availability of pediatric surgical services and specialists, radiologic modalities, maintenance of hospital records and available data on intussusception. Cases of intussusceptions in children <10 years of age seen at the Malankara Orthodox Syrian Christian (MOSC) Medical College and Hospital at Erna-kulam in Kerala from April 2013 to April 2015 were reviewed. Data for each identified case, such as age, gender, details of intussusception, and history of receipt of rotavirus vaccine were collected by reviewing computerized admission records, surgical records and radiology logs. All children admitted for intussusception were included.

The survey data was compiled and stratified by geographic region. The data from MOSC Hospital was summarized and stratified by age. Details of the population of the region around MOSC Hospital were obtained from the Demographic indicators report (2013), Government of India [8]. We estimated that 40% of the population uses the hospital for pediatric emergencies. The incidence rate of intussusception was calculated using total number of cases divided by total number of population at risk. A Poisson model was used to calculate the 95% confidence interval (CI).

RESULTS

Twenty-one (75%) of the hospitals in the network completed the survey. The key descriptors of each hospital are included in **Table I**. The data from the regions indicate that at least one hospital in the Southern (MOSC Medical College Hospital, Kolenchery; Om Hospital, Tirupati; and Christian Medical College, Vellore), Northern (St. Stephen's Hospital, Delhi) and Western (Kore Hospital, Belgaum; KEM Hospital, Pune; Lokmanya Tilak Municipal Hospital, Mumbai) regions of the country already have records available, and can record and analyze case data for sentinel surveillance of

intussusception. In the eastern region, it should be feasible to establish surveillance at the Institute of Child Health, Kolkata in 2016. On the other hand, the survey data also established that some hospitals would be unsuitable for inclusion in a surveillance network because of the lack of availability of diagnostic and management facilities.

Data from MOSC Hospital – which provides healthcare for over five million population from Ernakulam and Idukki district, Kerala, with an average of 3000 pediatric outpatient and 800 inpatients annually – showed that during the two year study period, there were

TABLE I DESCRIPTION OF SELECTED HOSPITALS PARTICIPATING IN THE NATIONAL ROTAVIRUS SURVEILLANCE NETWORK

<i>Name and location*</i>	<i>Type of facility</i>	<i>No. of pediatric/ ped</i>	<i>No. of ped surgeons beds</i>	<i>Special radiology surgeons</i>	<i>Hospital records retained at hospital</i>	<i>Current intussusception records in hospital</i>
<i>East Zone</i>						
ICH, Kolkata	Govt	160/37	2	US, MRI, no CT	Electronic from Jan 16	10 cases in 7 yrs
Assam Med Coll, Dibrugarh	Govt	130/35	4	US, CT, MRI	Yes, no ICD coding	4 in 1 year
<i>North Zone</i>						
NSC Bose MCH, Jabalpur	Govt	72/30	2	US, CT, MRI	Yes	3 in 1 year
SVBP Hosp, Meerut	Govt	60/20	1	US	Yes	No
KS Hosp, Delhi	Govt	300/60	4+10	US	Yes	Unknown
Hamidia/Kamla Hosp, Bhopal	Govt	140/30	3	US, CT	Yes	Unknown
St. Stephen's, Delhi	Private	38	2/1PT	US, CT, MRI	Yes	01/13 to 08/15=17
<i>West Zone</i>						
<i>Kore Hosp/</i>						
JNMC Belgaum	Private	130/20	2	US, CT, MRI	Yes	08/14 to 8/15=47
Krishna Hospital, Karad	Private	120/20	1	US, CT, MRI	Yes	08/14 to 8/15=2
Civil Hospital, Ahmedabad	Govt	210/30	2	Referral	No ICD coding	20 in 1 year
LTMH, Mumbai	Govt	175/60	8	US, CT, MRI	Yes	1/15 to 8/15=32
KEM Pune	Private	100/25	4	US, CT, MRI	No ICD coding	40 per year
Bharati, Pune	Private	90/20	2	US, CT, MRI	Yes	19 in 14 months
Shaishav Clinic, Pune	Private	75/10	Part-time	US	No ICD coding	4 in 1 year
<i>South Zone</i>						
Pragna Hosp, Hyderabad	Private	64/8	2	US	Yes	No
MOSCMC, Kolenchery	Private	80/12	2	US, CT, MRI	Yes	04/13 to 03/14 = 46 04/14 to 03/15 = 57 04/15 to 08/15 = 22
CMC Vellore	Private	160/32	8	US, CT, MRI	Yes	2013: 34, 2014: 32 2015: 21
SV Hosp, Tirupati	Govt	220/30	2	US	Yes	06/14 to 05/15=8

*qPed surg-pediatric surgery, US-ultrasound; *District Hospital, Dimapur (East Zone), SMIMER Hospital Surat (West Zone), Child Jesus Hospital, Trichy (South Zone) are not included as they refer all cases of suspected intussusception.*

TABLE II ESTIMATED INCIDENCE RATE OF INTUSSUSCEPTION AMONG CHILDREN (AGE <10 Y) AT MOSC MEDICAL COLLEGE HOSPITAL, ERNAKULAM, KERALA, 2013-2015

Age (in months)	No. of cases (%)	Time at risk years	Population at risk	Incidence rate*	95% CI
<6	13 (12.3)	2	40870.61	39.8	23.1 - 68.5
6 - 12	40 (37.7)	2	44289.87	112.9	82.8 - 153.9
13 - 24	16 (15.1)	2	43351.75	46.1	28.2 - 75.3
25 - 60	29 (27.4)	2	133378.57	27.2	18.9 - 39.1
61 - 108	8 (7.5)	2	183447.66	5.5	2.7 - 10.9
Total	106	2	445338.46	29.8	24.6 - 35.9

*Per 100,000 person-years; Incidence of Intussusception = (No. of cases/Population at risk × time at risk × 0.40) × 100 000.

106 children (age <10 years) diagnosed with intussusception. The male-female ratio was 1.9:1. All 106 cases were diagnosed radiologically, and 96 (90.6%) were reduced by hydrostatic enema, while 10 (9.4%) required a laparotomy. None of the cases had history of receiving rotavirus vaccination. All children recovered.

The average incidence of intussusception in children <10 years was 29.8 (95% CI, 24.6 - 35.9) per 100,000 child-years, with the highest incidence (112.9 per 100,000 child years) in the 6-12 month age group (**Table II**).

DISCUSSION

The survey of hospitals which were selected for inclusion in the NRSN for their ability to recruit children hospitalized with gastroenteritis showed that in major geographic regions of India, there are one or more hospitals that can also serve as sentinel facilities for intussusception surveillance. This is important because fewer resources will be required if the same hospitals can be used for surveillance for impact and safety when the rotavirus vaccine is introduced into the Universal Immunization Program.

Only a few hospitals within the rotavirus surveillance network were suitable for inclusion for monitoring of intussusception, and most smaller hospitals refer children that may require surgery. Management of intussusception at hospitals within the network is undertaken only at hospitals that have pediatric surgery services (**Table I**), even though reduction of intussusception is increasingly without surgery. Monitoring of intussusception, irrespective of when rotavirus vaccine is introduced, requires ensuring awareness and appropriate referrals among healthcare providers. Monitoring of the rate of intussusception following vaccine introduction requires preparation of hospitals to accurately record vaccination information for all cases of intussusception, which needs appropriate investment in training and data capture. All of these issues will need to be addressed by the next iteration of the ICMR network, which is now preparing for both

effectiveness and safety monitoring.

The background incidence rate of intussusception reported from MOSC Hospital is higher than the only other incidence data from India, which is from Delhi, and was based on two cases in the age group studied [9].

The limitation of the survey and this retrospective hospital-based study might be lack of quality of documentation, and incomplete clinical records. In terms of incidence, the rates may be under- or over-estimated depending on the proportion of the population accessing healthcare at MOSC Hospital. However, even at the highest rate of 113 in the 6-12 month age group in Kolenchery, these estimates are lower than reported for the whole period of infancy from other Asian countries such as Japan, Vietnam and South Korea, where the incidence of intussusception was 158, 296 and 326 per 100,000 child-years, respectively [10-12].

Overall, information on intussusception is needed, particularly when rotavirus vaccination is introduced, and the use of sentinel facilities will support safety monitoring post-vaccine introduction. However, promotion of awareness and rapid referral should be emphasized to ensure appropriate case management of intussusception. Careful recording of vaccination information will be needed to determine whether cases are in the risk window following vaccination or not, in order that vaccine associated risk is accurately estimated.

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Competing interest: RA heads the Epidemiology and Communicable Diseases Division at ICMR.

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WHAT THIS STUDY ADDS?

- Hospitals participating in the National Rotavirus Surveillance Network will be a valuable resource to monitor safety after rotavirus vaccine introduction into the Universal Immunization Program of India.
- Surgical interventions are required in only a small proportion of cases of intussusception, with most reductions achieved radiologically.

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