

Hong Kong Intussusception
Study Group*

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- Objectives** To assess trends in intussusception and to validate the coding in Hong Kong's computerised discharge information system.
- Design** Case notes were reviewed for all children under the age of 5 years who had a discharge diagnosis indicating intussusception or a procedure indicating reduction of intussusception during the 6-year period 1 July 1997 through 30 June 2003.
- Results** Intussusception rates for infants under 1 year of age (108/100 000) and under 5 years of age (38/100 000) were slightly higher than previous estimates (78-100/100 000 and 27-32/100 000, respectively) that used passive discharge data alone.
- Conclusions** Hong Kong's passive computer data systems could be used to monitor rates of intussusception after the introduction of new rotavirus vaccines, provided readmissions, inter-hospital transfers, and hospital follow-ups for the same episode are taken into account.

Introduction

Rotashield, an oral tetravalent rotavirus vaccine, was licensed by the Food and Drug Administration in 1998 and recommended for use in the routine immunisation schedule of all United States infants. The vaccine was withdrawn in the latter part of 1999, as its use was associated with intussusception.¹⁻⁴ Initial estimates of the intussusception risk due to the vaccine was 1 in 10 000 but subsequent analyses suggested a lower risk, which increased with increasing age.⁵ Using computerised discharge data from the Clinical Management System (CMS) of Hong Kong's Hospital Authority (HA), the incidence of hospitalisation for intussusception in Hong Kong infants under the age of 1 year was previously estimated to be 78-100/100 000 for the period July 1997 to June 1999 inclusive,⁶ which was greater than that encountered in the United States and Europe.⁶ To assess intussusception trends and validate the CMS coding, this study reviewed the case notes of all children under the age of 5 years who had a CMS discharge diagnosis indicating intussusception or a procedure indicating correction of intussusception during the 6-year period 1 July 1997 to 30 June 2003.

Methods

The CMS, introduced in the latter part of 1996, collects uniform discharge and other information on all patients admitted to HA hospitals throughout Hong Kong. Such information included patient identifiers, date of birth, sex, a maximum of 15 diagnoses and 15 procedures (classified by the International Classification of Diseases [ICD9-CM] codes), and admission and discharge dates. Information was retrieved on patients admitted to any ward (medical or surgical) with a diagnosis coded as ICD 560.0 (intussusception) or any procedure coded as ICD 46.80 (reduction of intussusception) during the 6-year period 1 July 1997 to 30 June 2003. As it was possible that a proportion of patients with intussusception will not have had a correctly recorded ICD code at discharge, information from the Radiology Information System (RIS) was also obtained for all patients that had a radiological investigation indicating reduction of intussusception, namely: RIS Exam Codes (3102 Ultrasound [General]—Intestine, including pyloric stenosis, intussusception etc; 7405 Interventional Radiology [Gastrointestinal Tract]—reduction of intussusception).

A trained research assistant abstracted initial data to the case report form (CRF). These data were reviewed by one of the investigators, to determine whether the corresponding patient met the inclusion criteria and to confirm the method of diagnosis. Patients were included in the study only if they were aged younger than 60 months at the time intussusception was diagnosed radiographically, surgically, or by postmortem

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Key words
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香港兒童患腸套疊的趨勢

- 目的** 評估香港兒童患腸套疊的趨勢，並確認香港病人出院資料電腦系統所用的編碼方法是否有效。
- 設計** 檢視在1997年7月1日至2003年6月30日期間入院、5歲以下病童的病歷，他們的病歷必須顯示病童在出院時曾被診斷為患上腸套疊或病童曾接受腸套疊整復治療。
- 結果** 1歲以下新生兒患腸套疊的比率（108/100 000）和5歲以下的比率（38/100 000），略高於過往單靠被動的病人出院數據所作的預測（前者為78-100/100 000，後者為27-32/100 000）。
- 結論** 在香港引入新的輪狀病毒疫苗後，假如能考慮同期的再次入院、醫院轉介以及出院後的隨訪，被動的電腦數據系統可用於監測腸套疊的病發率。

examination during the defined surveillance period. Children were excluded if the diagnosis was based solely on clinical signs and symptoms. Each case note reviewed was further classified: primary admission with intussusception (no inter-hospital transfer); primary admission with intussusception transferred from another hospital; primary admission with intussusception transferred to another hospital; readmission with a new primary diagnosis of intussusception (children with more than one separate admission for an intussusception); follow-up for previous admission with intussusception (not a case of intussusception); readmission with the same episode of intussusception (not a new intussusception); and wrongly coded (not a case of intussusception).

The CRF was used to abstract demographic

details and information on: medical history, including gastro-intestinal problems and previous admissions; immunisation history; travel history; clinical signs and reported symptoms noted on admission. The latter included pain, irritability, inconsolable crying, lethargy, vomiting, diarrhoea, blood and mucus in stools. Admission information was also collected on examination findings and the patient's general condition (well, alert, restless, irritable, lethargic, unconscious, floppy), vital signs (features of shock, pallor, or dehydration), abdominal masses, distension, tenderness, rectal examination findings, as well as corresponding available investigation results. Such investigations included: blood count, liver/renal function tests, ultrasound examination, plain abdominal radiographs, air or contrast enemas, stool samples, and nasopharyngeal aspirates; how intussusception was diagnosed (by air enema, barium enema, ultrasound, or at surgery); the method of treatment (none, ie spontaneous resolution; successful radiological reduction [liquid, hydrostatic or air enema], or failed radiological reduction [referred for surgery]). In the latter eventuality, whether surgical resection and/or intensive care treatment was undertaken was also noted. Details of medications given and the eventual outcome (recovered, deceased, or transferred to another hospital) were also abstracted. The Chinese University of Hong Kong's Clinical Research Ethics Committee, as well as corresponding Ethics Committees of individual hospitals approved the study.

Descriptive statistics were used for analysis. Clinical signs and symptoms, diagnosis, curative measures, outcome, and immunisation history of the intussusception cases were tabulated. Tables were generated giving the frequency of intussusception by season. The incidence of intussusception, with 95% confidence intervals (CIs) in children less than 5 years old and less than 1 year old was computed for each year and overall. The numerator consisted of all cases of definite intussusception identified in this study including deaths due to definite intussusception. The annual incidence was calculated as the number of new cases reported in the study period divided by the susceptible population based on the birth cohort, with the assumption that 90% of in-patient care occurs in government hospitals.⁷

Results

A total of 688 potential patients with an admission diagnosis of intussusception were identified through the CMS and an additional 15 through the RIS. Review of the corresponding 703 case notes yielded 604 admissions with a diagnosis of intussusception for further analysis. Those not included were 49 children admitted for follow-up and 50 whose diagnosis was shown not to be intussusception on review. However

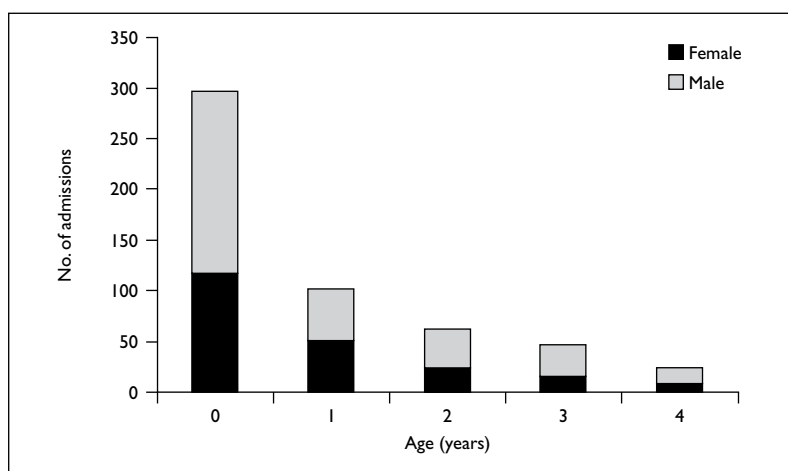


FIG 1. Age and sex distribution of patients with definite intussusception admitted to all Hospital Authority hospitals during the 6-year period 1 July 1997 to 30 June 2003 (n=531)

a number of patients had two or more separate episodes of intussusception; in all there were 531 individual subjects: 21 had two separate episodes, and four had three episodes. Overall 40 intussusception admissions involved inter-hospital transfers. Twenty-four children had a recurrence of intussusception during their admission and four were readmitted for the same episode of intussusception. Due to duplication of various coded diagnoses, without a review of case notes the CMS and RIS diagnosis alone overestimated the numbers of subjects with intussusception by 24% ([703-531]/703) and the number of separate episodes by 17% ([703-531-54]/703). The wrong diagnosis was coded in 7% of cases. One child was reported to have died. In 11 (2%) of the patients intussusception resolved spontaneously, in 355 (67%) after radiological manoeuvres, and in 165 (31%) as a result of surgery or another intervention.

The mean age of those affected was 15.9 months (standard deviation, 14.1 months), the median age was 10.0 months and the male:female ratio was 1.5:1. Fifty-six per cent of cases were in infants (Fig 1). The majority of the parents were ethnic Chinese (mother 95%, father 96%). There was no apparent seasonality of intussusception (Fig 2⁸). Vomiting and features of abdominal pain were the most common presentations (Table 1), although information on possible abdominal pain was missing in 100 subjects. Abdominal mass on examination was noted in 46% and blood on rectal examination in 28% (Table 1). Diagnosis was mainly by ultrasound alone (79.7%), air enema alone (8.7%), or barium enema alone (6.4%) [Table 2].

In 13 subjects diagnosis was made at surgery. Eight per cent of children had been admitted to hospital in the previous 4 weeks. Information on previous immunisation was usually not available in the case notes. In 9% (16/180) there was a history of vaccination in the past month.

Total Hong Kong live births were used to estimate the incidence and it was assumed that 90% of the birth cohort would have been admitted to HA hospitals.⁷ The annual incidence in children under 5 years old was 38/100 000 (95% CI, 35-42/100 000) and in those under 1 year old it was 108/100 000 (95% CI, 95-120/100 000) [Table 3]. There was no consistent trend in the incidence of intussusception during this 6-year period (Fig 3).

Discussion

Annual intussusception incidence rates per 100 000 births were estimated for 1997 to 2003 using total Hong Kong live births as denominators (Table 3). The estimated rate of hospitalisation for intussusception excludes those to Hong Kong private hospitals, which was assumed to account for 10% of all such in-patient admissions.⁷ The HA statistical reports

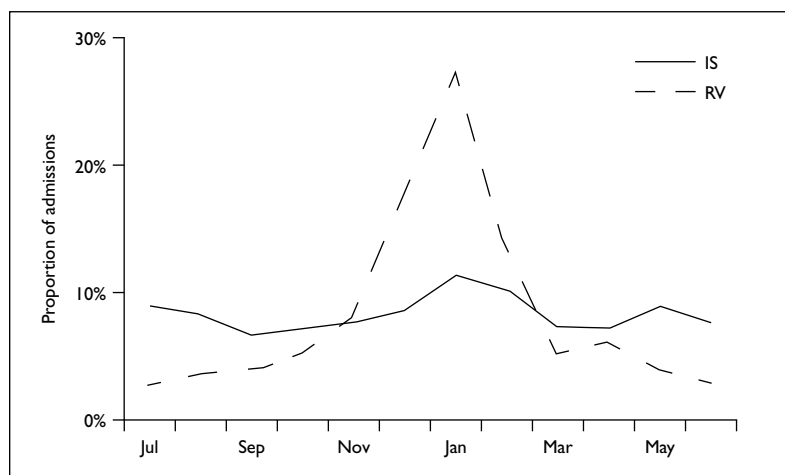


FIG 2. Month of admission of patients with definite intussusception (IS) [n=531] admitted to all Hospital Authority hospitals during the 6-year period 1 July 1997 to 30 June 2003 and of cases of rotavirus (RV) diarrhoea (n=1758) admitted to four active sentinel surveillance hospitals during the 2-year period 1 April 2001 to 31 March 2003⁸

TABLE 1. Clinical signs and symptoms noted on admission (n=531)

	No. (%)	Missing data
Information available from initial history		
Vomiting	432 (81)	-
Possible abdominal pain	265 (61)	100
Irritability	209 (40)	7
Blood in stool	197 (37)	2
Diarrhoea	183 (34)	-
Blood per rectal exam	101 (19)	2
Crying	88 (17)	11
Abdominal mass	90 (17)	1
Lethargy	82 (16)	12
Mucous in stool	80 (15)	2
Examination findings at time of admission		
Abdominal mass	246 (46)	-
Blood noted on rectal exam	149 (28)	-
Possible abdominal tenderness	131 (25)	1
Dehydration	125 (24)	6
Abdominal distension	122 (23)	1
Fever	108 (21)	6
'Red currant jelly' stool	86 (16)	-
Abnormal bowel sounds	78 (15)	-
Pallor	22 (4)	-
Rectal mass	3 (1)	-
Rebound or peritonism	1 (0.2)	1
Rectal prolapse	0	-

for the periods 1997/1998 to 2003/2004 revealed that 11.6% of patients (of all ages) with ICD-9 code 560 (intestinal obstruction without mention of hernia), or

TABLE 2. How intussusception was diagnosed (n=531)

	No. (%)
Ultrasound only	423 (79.7)
Air enema only	46 (8.7)
Barium enema only	34 (6.4)
Surgery only	10 (1.9)
Ultrasound and surgery	1 (0.2)
Ultrasound and air enema	4 (0.8)
Ultrasound and barium enema	5 (0.9)
Air enema and surgery	2 (0.4)
Air enema and barium enema	1 (0.2)
Other or unknown*	5 (0.9)

* Include computed tomographic scan and clinical diagnosis

with ICD-10 code K56 (paralytic ileus and intestinal obstruction without mention of hernia) from the 2001/2002 report onwards, were treated in private hospitals (www.ha.org.hk). There was no clear trend in these private hospital admission rates (Fig 3) to suggest that variations in intussusception incidence were related to the changing proportion of cases treated in private hospitals. However as data from the HA statistical reports do not specifically refer to intussusception or to the age range less than 5 years, it is difficult to conclude whether variations in admissions to private hospitals could account for variations in intussusception incidence. It should also be noted that there are no data on the extent to which Hong Kong-born infants receive treatment in mainland

TABLE 3. Incidence of intussusception (IS) for subjects under 1 year and under 5 years of age assuming that 90% of all such children (n=531) visit Hospital Authority hospitals

Year	Birth cohort	Age <5 years			Age <1 year		
		No. of definite IS cases	Annual incidence of IS per 100 000	95% CI	No. of definite IS cases	Annual incidence of IS per 100 000	95% CI
1997	29 569*	39	29.3	20.1, 38.5	21	78.9	45.2, 112.6
1998	53 000	93	39.0	31.1, 46.9	53	111.1	81.2, 141.0
1999	51 300	97	42.0	33.7, 50.4	50	108.3	78.3, 138.3
2000	54 100	109	44.8	36.4, 53.2	65	133.5	101.1, 165.9
2001	48 200	88	40.6	32.1, 49.0	48	110.6	79.4, 141.9
2002	48 200	70	32.3	24.7, 39.8	42	96.8	67.5, 126.1
2003	22 534*	35	34.5	23.1, 45.9	18	88.8	47.8, 129.7
Total	306 903	531	38.4	35.2, 41.7	297	107.5	95.3, 119.7

* Birth cohort for the year 1997 and 2003 was adjusted, since the study was not conducted for the entire year in 1997 and 2003 (the survey was from 1 July 1997 to 30 June 2003)

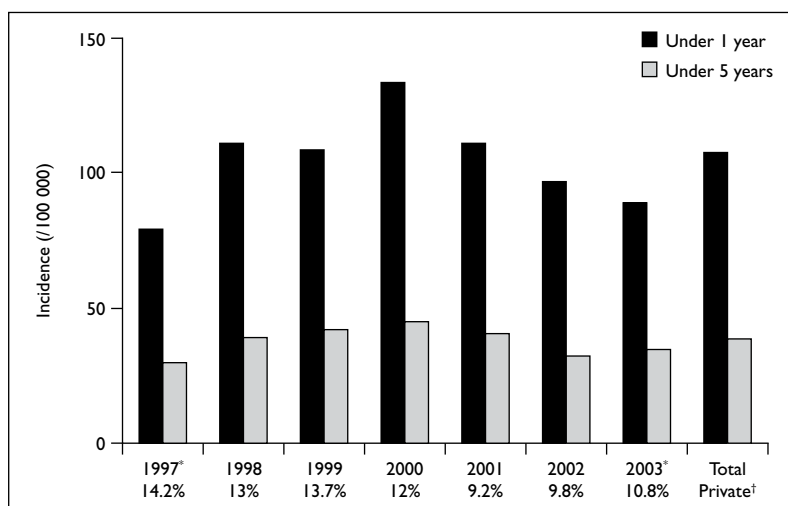


FIG 3. Trends in incidence by age for patients with definite intussusception (n=531) admitted to all Hospital Authority hospitals during the 6-year period 1 July 1997 to 30 June 2003 relative to the percentage of admissions to private hospitals (all ages) with intestinal obstruction without mention of hernia (ICD-9 code 560) or paralytic ileus and intestinal obstruction without mention of hernia (ICD-10 code K56)

* Birth cohort adjusted as data only collected for 6 months for these years

† Private=% admissions (all ages) to private hospitals with ICD-9 code 560 or ICD-10 code K56 derived to Hospital Authority statistical reports 1997/1998 to 2003/2004 with adjustment for calendar year

China. Acknowledging these potential limitations our rate of intussusception for infants under 1 year of age (108/100 000) was slightly higher than our previous estimate (78-100/100 000) using the passive CMS data alone.⁶ Our rate of intussusception for infants under 5 years of age (38/100 000) also appears somewhat higher than our previous estimate (27-32/100 000).⁶ For subjects under 1 year old, our rates are high compared to the United States (18-56 per 100 000),^{9,10} and the United Kingdom (66 per 100 000).¹¹ Intussusception hospitalisation rates in the United States have been noted to vary by race; being 27 to 37 in whites, 32 to 50 in blacks, and highest (112-217) among infants of other races.⁹

The ICD codes that are entered into the CMS are selected by the responsible medical officer at the time of the patient's discharge. The system allows the doctor to type in an ICD code directly if known or to use a keyword search. Thus, the ICD codes entered may be influenced by a number of factors including the availability of laboratory results at the time of discharge. By reviewing the case notes of all patients

coded as intussusception, we were able to establish which patients had been incorrectly coded. Use of data from the RIS enabled us to identify an additional 15 cases that did not have a CMS code indicating intussusception. It is possible that there were some additional definite cases that did not have either a CMS or RIS indicative code of intussusception. Review of surgical and radiological logbooks might have identified such cases but this was not feasible with the available resources.

This case-note review of intussusception admissions at HA hospitals in Hong Kong shows an incidence similar to that estimated from passive surveillance data alone.⁶ The present study estimate also took account of inter-hospital transfers and follow-up visits for the same episode of intussusception, which accounted for 24% of recorded admissions. The annual incidence of intussusception appeared to peak in 2000. However, it is not possible to conclude that there has been a consistent downward incidence trend since then, though such trends have been noted elsewhere.¹² The CMS and RIS systems could be used to monitor intussusception rates after the introduction of new rotavirus vaccines, provided re-admissions, inter-hospital transfers, and hospital follow-ups for the same episode are accounted for.

Declaration

This research project received financial support from GSK Biologicals. EAS Nelson has received funding and support from Merck for rotavirus surveillance studies, is currently principal investigator of a phase 3 rotavirus vaccine study funded by GlaxoSmithKline, and has received lecture fees and travel support from Glaxo-SmithKline. YL Lau is currently a principal investigator of a phase 3 rotavirus vaccine study

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