

Epidemiology and Seasonal Variation of state Hospital Admissions for Bronchiolitis among children in Malta

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Abstract

Bronchiolitis is a seasonal viral illness characterised by breathing difficulties, cough, poor feeding, irritability and lethargy and, in the very young, apnoea.¹ General Practitioners (GPs) often encounter children with bronchiolitis and as GPs working in Malta, we noticed certain patterns of infection, such as the young age of this patient group, the increased frequency of occurrence in the winter months and a commonly reported history of Neonatal Intensive Care admission.

We therefore looked for published local literature to determine the local epidemiology of this illness and found none. Review of the international literature led to an understanding of the existence of a specific seasonality of bronchiolitis in the northern hemisphere, with more admissions being recorded in the winter months.²⁻⁷ Particular trends in the demographics of admitted children were noted in the literature, specifically with younger patients, as well as children with previous Neonatal and Paediatric Intensive Care admission being more frequently admitted.³⁻⁵ This retrospective study was undertaken in order to establish whether there is any seasonal variation in the rate of hospitalization for bronchiolitis, what observations could be made about epidemiological factors describing these admissions and their radiographic and microbiological investigation in secondary care.

Aim and intended learning outcomes: The aim of this retrospective study was to determine the local seasonality of hospital admission for bronchiolitis. Once determined, the results should aid physicians with diagnosis, referral and appropriate admission, and may guide promotion of vaccines that decrease the burden of vaccine preventable disease.

Method: Records of hospital admissions for bronchiolitis among infants or children under two years of age at Mater Dei Hospital in Malta for the four year period covering January 2008 to December 2011 were examined, due to availability of data. Admission data, mainly name and patient identification number, together with basic demographics like locality of residence and dates of admission were collected from the Department of Health Information and Research and was used to identify the recorded cases after obtaining necessary permits from the Head of the Paediatric department at that time and also from the University of Malta Ethics Board. The diagnosis leading to the classification of the admission as one for bronchiolitis was validated by examining a significant sample of the doctors' notes in the relevant patients' files and matching these against clinical criteria for diagnosis.¹ The number of admissions due to bronchiolitis per day was recorded. Each day, with its corresponding number of admissions was put accordingly into one of four groups as shown—Group 1 all days in December, January and February; Group 2 all days in March, April and May; Group 3 all days in June, July and August; Group 4 all days in September, October and November. These were then ranked, and a non-parametric test of significance, the Kruskal-Wallis equality-of-populations rank test, was used to determine whether there was any significant difference between the groups.

Results: Our findings show a peak in admissions during the winter months. The median age of admission among children under two years of age was of 16 weeks; 10% had a past history of NPICU admission. 54.4% had a chest X-ray done and 41.6% were tested for causative organisms with a throat swab. Of the 41.6% tested, 19.4% tested positive for the Respiratory Syncytial Virus. The other results of these clinical tests are also described.

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Conclusions: In Malta, there is a higher number of hospital admissions for bronchiolitis among infants or children under two years during the winter months. The median age for admission is 16 weeks. Further studies are suggested to establish whether previous Neonatal and Paediatric Intensive Care Unit admission is a risk factor for bronchiolitis in Malta, and appropriately designed prospective studies are suggested to further assess the occurrence of causative organisms. We also suggest that national guidelines be drawn up for use in primary care for the appropriate identification and referral of cases of bronchiolitis, which peaks in the winter months.

Keywords

bronchiolitis, Malta, respiratory, epidemiology, seasonality

Background

Bronchiolitis is a seasonal viral illness characterised by breathing difficulties, cough, poor feeding, irritability and lethargy and, in the very young, apnoea.¹ It is the commonest cause for hospitalisation of infants in the developed world.⁶ It is a transmissible disease, transmitted through direct contact with respiratory secretions and indirect inoculation from surfaces. It generally presents as a one to two day history of upper respiratory tract symptoms followed by moist cough, respiratory distress and feeding problems once the lower airways are involved. Treatment is mainly supportive and varies from treatment at local clinics intermittently to continuous inpatient treatment and at times ITU care.⁶⁻⁸

International studies which depicted seasonality of bronchiolitis showed an increase in admission rate in the winter months^{3,4,4-6,8-19} with the months November and March being those in which the highest admission rate was noted in the northern hemisphere. We wanted to determine whether Malta followed a similar pattern.

Common points encountered in many articles also include the age of the infants who were affected. The highest prevalence of bronchiolitis was seen mainly in infants less than six-months old^{3,4,11,15-17,19-24} with a decrease in occurrence noted as the infants become older.^{14,25-27} An increase in overall bronchiolitis admission rates over the recent years was also noted internationally with some studies quantifying more than a doubling in admission rate in the last 10 years, despite a relatively stable admission rate with other respiratory tract disease like pneumonias or exacerbations of asthma.^{4,6,15-18}

A curiosity regarding the local situation arose, in line with the literature read together with patterns, which were noted by us General Practitioners. Henceforth, a study was set up to investigate the matter in question.

Methods

Denominator population:

All recorded bronchiolitis admissions (as provided by the Department of Health Information and Research) of infants aged 0-2 years admitted to paediatric medical wards at Mater Dei Hospital in the four year period between 2008 and 2011 were included in the study. The date of admission and patient demographics were then recorded.

The identity of all admissions falling under the ICD 10 classification J21.0 to J21.9 was obtained from the Department of Health Information and Research, after obtaining ethics approval and approval from the Head of Department of Paediatrics, Data Protection Officer and Hospital CEO at the time of the study.

Authentication of the criteria for definition of bronchiolitis was done by sampling at random 1 in 15 files of patients admitted, using the method outlined below [see Validation] and verifying that what was classified as bronchiolitis in the discharge letter was in fact bronchiolitis as described in the Scottish Intercollegiate Guidelines Network (SIGN) guidelines, by nature of the relevant clinical features being present.

Data collection:

All cases recorded by the Department of Health Information and Research as having been admitted to Mater Dei hospital for bronchiolitis with ICD 10 Classification J21.0-J21.9 between January 2008 and December 2011 were identified by the corresponding national identity number.

For each of these, relevant available demographic data such as location of residence, gender and age were noted. Any preceding or consequent NPICU admissions, radiographic, viral or microbiological tests taken during admission were also found on the Mater Dei hospital electronic database iSoft [henceforth, iSoft database] and recorded on a purposely designed database.

Quality checks and control:

Validation: In order to validate the correct use of the term 'bronchiolitis' in diagnosis and registration on the DHIR database, we randomly sampled a significant number of incidents of hospitalisation for bronchiolitis and the corresponding patient records (hospital files) were examined to check if the clinical features noted during the hospital stay were compatible with a clinical diagnosis of bronchiolitis as defined in the SIGN guidelines for bronchiolitis. Random selection of the files involved listing all the admissions chronologically and 1 in 15 files was called for and data was checked.

Bias: Since we relied upon data collected by the Department of Health Information and Research, in part gathered through the use of the Electronic Case

Summaries system which came into use in 2008 (usage rate of 60-70% in the first 2 years of use and 85% in the last 2 years) the data for the first 2 years would be subject to bias in detection of cases.

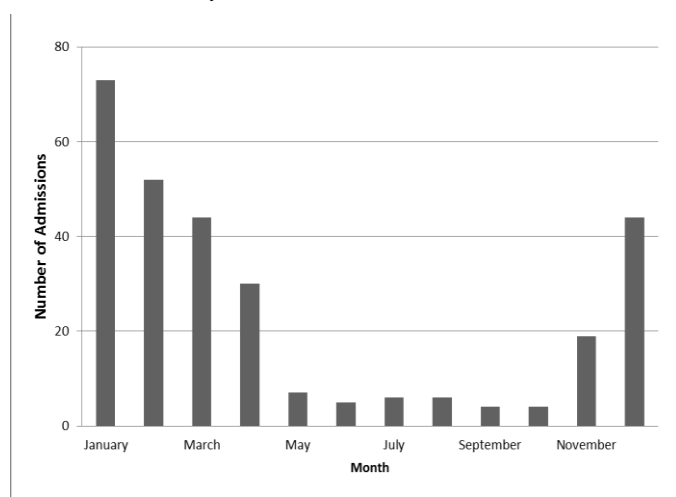
Results and analysis

Age, Gender and Monthly Variation of Admissions: General Observations

A total of 298 admissions for bronchiolitis were recorded in this period. Of these, 194 were males and 104 were females. The age range of the infants was between 13 days and 82 weeks old. The median age was 115.5 days (16.5 weeks); the first quartile age was 68 days while the third quartile age was 183 days. From the sample taken, we found that 60% had both nasal discharge and cough, 36% had a cough without nasal discharge while less than 0.05% had nasal discharge without cough. Fine inspiratory crackles were present in about 20% of the sampled population while high pitched wheeze was present in 64% of the sampled population. On reviewing the notes of the sampled population, we concluded that the diagnosis of bronchiolitis was in line with clinical guidelines in all cases.

The number of admissions to Mater Dei Hospital due to bronchiolitis during each month between January 2008 and December 2011 is shown in Figure 1. From the graph, it is evident that the number of admissions was higher during the winter months, particularly December and January.

Figure 1: Number of admissions per month between January 2008 and December 2011



Seasonal Differences: Kruskal-Wallis Rank Test

In order to determine whether there is a significant seasonal difference in the median number of admissions, the twelve months of each year were grouped into four categories as follows:

- Group 1: December, January and February
- Group 2: March, April and May
- Group 3: June, July and August
- Group 4: September, October and November.

For every group, each day within the included months was listed alongside the corresponding number of admissions for that day. These were then ranked, and a non-parametric test of significance, the Kruskal-Wallis equality-of-populations rank test, was used to determine whether there was any significant difference between the groups. The null hypothesis was that there is no difference in the median number of admissions between each group while the alternate hypothesis was that there is a significant difference in the median number of admission between each group.

Table 1: Rank Sum values for Kruskal-Wallis analysis for the four groups.

Group	Observations	Rank Sum
1	361	316608.00
2	368	272613.00
3	368	237068.00
4	364	241702.00

As expected, the most marked difference in the rank sum was that between Group 1 (December, January and February) and Group 3 (June, July and August). The chi-squared value was 68.197 with 3 degrees of freedom. The p-value was 0.0001. The null hypothesis was rejected and the alternate hypothesis was accepted. In other words, there is evidence that admissions due to bronchiolitis are greater in the “winter” months as opposed to “summer” months. This is in keeping with international observations.

Investigations during Hospital Admission

54.4% of the total population had a chest X-ray performed. Consolidation was evident in 3.7% of these and inflammatory changes were present in 7.4%. The vast majority (82.1%) were reported as normal by the radiologist (kindly refer to Figure 2). 3.7% of chest x-rays were not officially reported by radiology. 41.6% of the children were tested for causative organisms with a throat swab. 19.4% tested positive for Respiratory Syncytial Virus (RSV), while 2.4% tested positive for the influenza virus, 4% tested positive for the parainfluenza virus and 1.6% tested positive for adenoviruses. In 72.6%, no organism was isolated (kindly refer to Figure 3).

Figure 2: CXR findings

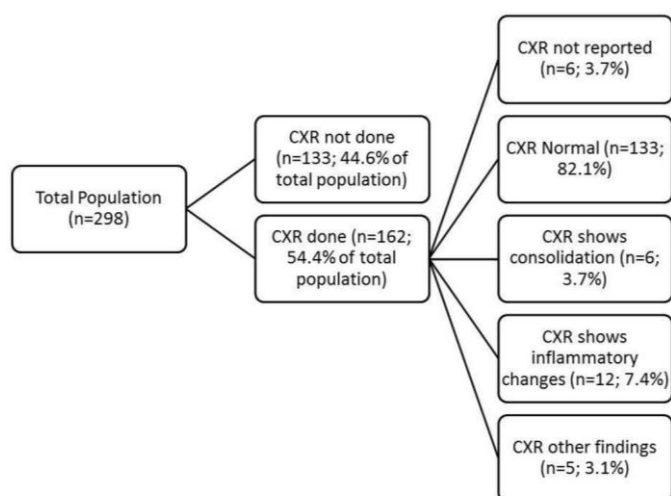
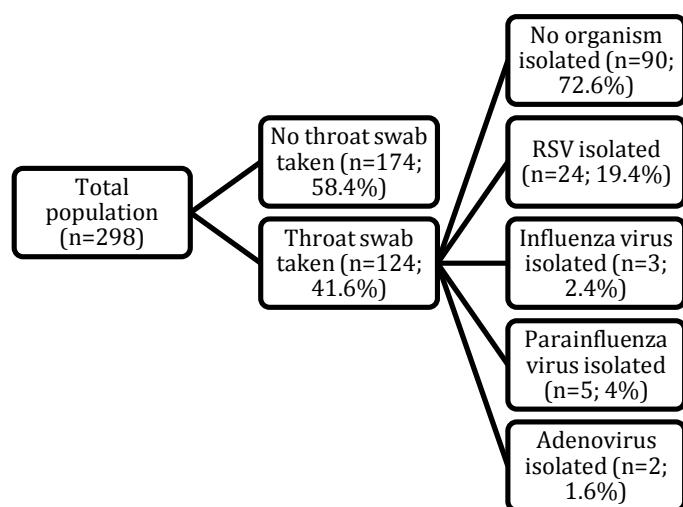


Figure 3: Isolates from the throat swab



Further observations

It was recorded that 10% had a past history of NPICU admission. This could not be compared to the international data since we did not acquire data for the years in question describing the local post natal NPICU admission rate and a breakdown of reasons for admission. Furthermore, we could not determine the gestational age at birth of the neonates admitted with bronchiolitis, and so cannot comment on preterm delivery as a risk factor for bronchiolitis. Further studies relating previous NPICU admission to subsequent admissions with bronchiolitis are recommended.

Summary and conclusion

In the single state general hospital in Malta, there is a higher number of hospital admissions for bronchiolitis among infants or children aged under two years during the winter months (November to February) in the four consecutive years studied. Locally, a rather stable rate of admission was noted over the years, excluding the single peak in 2008, as opposed to the steady increase over years reported in international literature.^{4,6,15-17}

Further studies are suggested to establish whether previous NPICU admission is a risk factor for bronchiolitis in Malta, and appropriately designed studies are suggested to further assess the occurrence of causative organisms. This study will also help highlight the red flags of bronchiolitis in children, especially in primary care, where one can only rely on clinical manifestations.

Appreciation

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