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Retrospective Study Of The Most Frequent Infections Affecting Children In The Pediatrics Department Of El Mansourah Hospital In Constantine - Algeria

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Abstract

The infectious diseases of the child are the main causes of high mortality associated with public health. No sufficient vaccination and inadequate conditions of hygiene are closely linked. The aim of this study was to determine the most frequent infections in children at El Mansourah hospital in Constantine (eastern Algeria) and to identify the main factors associated with the transmission of these infections. This was a retrospective study involving all cases of children aged between 1 month and 15 years hospitalized for an infectious pathology in the pediatrics department of El mansourah hospital in Constantine over a 3-year period, from 2016 to 2018; 598 cases were studied. The results show that acute respiratory infections (bronchiolitis and pneumopathy) and non-specific pulmonary infections (tuberculosis) are the most frequent with a rate of 31%, followed by urinary tract infections (20%) and meningitis (3.4%). The rate of bronchiolitis was higher (87%) than that of pneumonia (13%), with males predominating in both cases. The age group most affected by the latter is [1 month-2 years], and their frequency increases during the winter season. Tuberculosis is much more common in children aged [2-6 years] (43.8%), with a predominance of girls. Its frequency increases during the winter season (52.3%). Urinary tract infection was higher in girls (50.5%) than boys (49.5%) and more frequent in children aged [2-6 years]. The most frequent germ was E. coli compared with the other germs found. Viral meningitis was more frequent (70.3%) than bacterial meningitis (29.7%). Children aged between 2 and 6 were the most vulnerable, with 37.6%. The peak was observed during the spring (45.9%) and summer (35.1%) seasons.

Key words: *infection affecting children, retrospective study, respiratory infection, urinary tract infection, meningitis.*

Introduction

When an infectious agent enters into the body, it transmits an infectious disease. The infectious agent may be a fungus, a bacterium, a virus or a parasite. Their level of contagion and mode of transmission differ according to the nature of the infectious agent (Seventer et al., 2017). Humans, and more specifically small children, serve as a reservoir for the micro-organisms responsible for the infections usually encountered. Children are the age group most affected by bacterial or viral infectious diseases. What's more, children in low- and middle-income countries are ten times more likely to die before their 5^{th} birthday than children in industrialized countries. In 1998, the infant mortality rate still exceeded 100 per 1000 live births in more than 50 countries due to acute respiratory infections (especially pneumonia), diarrhea, measles, malaria or malnutrition, and often a combination of these conditions (WHO, 1999).

However, globally, pneumonia, diarrhea and malaria remain the leading causes of death in children under 5 (UN IGME, 2019). A total of 99% of neonatal deaths occur in poor

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countries (estimated average neonatal mortality rate (NMR) of 33/1000 live births), while the remainder occur in 39 high-income countries (estimated NMR of 4/1000 live births) (Bhutta, 2008).

In this context, the objectives of this study are to determine the most frequent infections in children admitted to pediatrics at El Mansourah hospital in Constantine (Eastern Algeria) and to establish the frequency of infectious pathologies as a function of various factors such as age, sex and season.

Materials and Methods

The study is a retrospective descriptive survey of patients hospitalized in the Pediatrics Department of the El Mansourah hospital in Constantine (Eastern Algeria) over a three-year period from 2016 to 2018. The entire pediatric population was included in the study, i.e. all children aged between 30 days and 15 years with infectious diseases hospitalized during the study period. The following data were collected retrospectively for each patient from the pediatric infectious diseases department's hospitalization register: age, sex, date of admission and discharge, reason for hospitalization, transfer from department/institution, antibiotic therapy in progress, infections (site, microorganism involved, antibiogram and treatment used). The data collected was processed using a statistical study.

Results

During this study, 1102 cases of infections were found in children in the Pediatrics Department at the El Mansourah hospital in Constantine, including 598 cases of the infections studied, compared with 504 cases of other infections. The results show that acute respiratory infections and non-specific pulmonary infections are the most frequent, with a rate of 31%, followed by urinary tract infections (20%) and meningitis (3.4%). These infections accounted for 54.4% of all infections in the pediatric department (Figure 01).

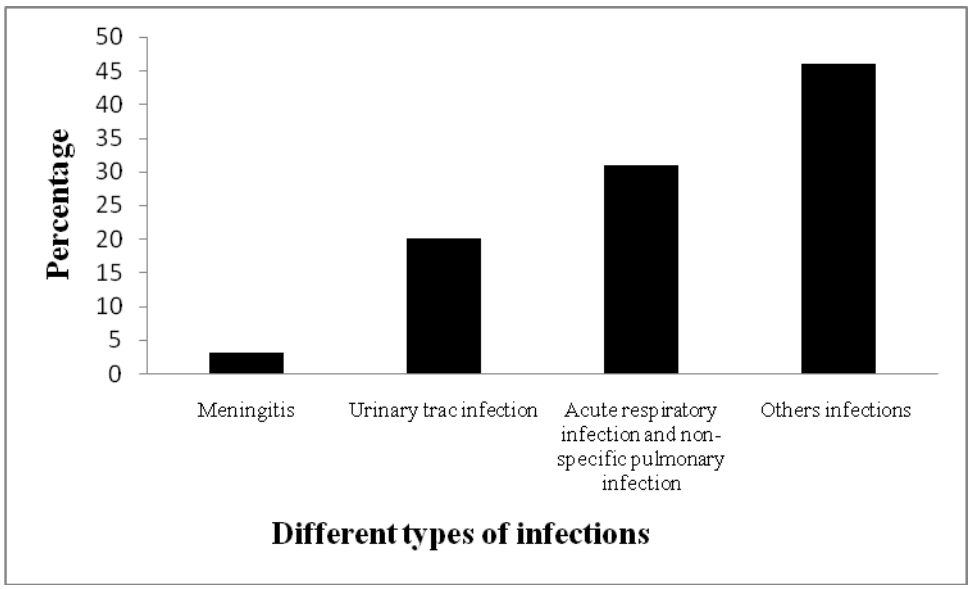

Figure 1. Distribution of infections in children at El Mansourah hospital in Constantine-Algeria.

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1. Distribution of respiratory infections affecting children

Acute respiratory infections (bronchiolitis and pneumonia) predominated, accounting for 29.5% (325 out of a total of 341 cases), compared with 1.5% for non-specific pulmonary infections (tuberculosis) (16 out of a total of 341 cases) (Table 01).

Table. 1. Distribution of respiratory infections affecting children

Type of infection	Number of cases	percentage
A respiratory infection and non-specific pulmonary infection	341	31
Acute respiratory infection (bronchiolitis and pneumonia)	325	29,5
Tuberculosis	16	1,5

1.1. Distribution of acute respiratory infections affecting children

The results show that among 325 cases of acute respiratory infections recorded, 283 were bronchiolitis (87%) and 42 (13%) pneumopathy.

- **Distribution according to age**

In this study, patients ranged in age from 1 month to 15 years. As shown in figure 02, acute respiratory infections in children were mainly found in children aged [1 month to 6 months], with 212 cases (186 cases of bronchiolitis and 26 cases of pneumopathy), i.e. approximately 65.2%; followed by children aged [7 months to 1 year], with 91 cases (85 cases of bronchiolitis and 6 cases of pneumonia), i.e. around 28%; and finally children aged [2 years to 6 years], with 21 cases (12 cases of bronchiolitis and 9 cases of pneumonia), i.e. around 6.5%. Acute respiratory infections were almost non-existent in the [7-10 years] age group, with a percentage of 0.3%, and non-existent in children over 11 years.

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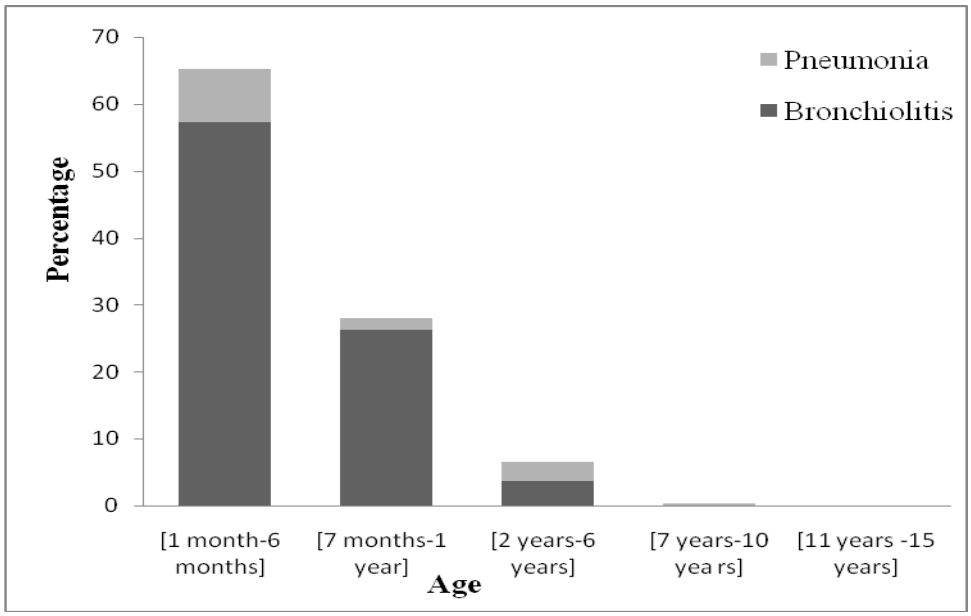

Figure 2. Distribution of acute respiratory infections in children according to age.

- **Distribution according to sex**

The distribution of acute respiratory infections in children by sex shows that among 325 cases of acute respiratory infections recorded, 232 cases were male (71.4%) and 93 females (2%), with a sex ratio of 2.5.

- **Distribution by month of the year**

There was an increase in the frequency of acute respiratory infections during the winter season, with a rate of 52.3%, compared with 12.1% in the dry season, with a clear peak in December (43 cases recorded, i.e. 13.2%) and January (70 cases recorded, i.e. 21.5%) (Figure 3).

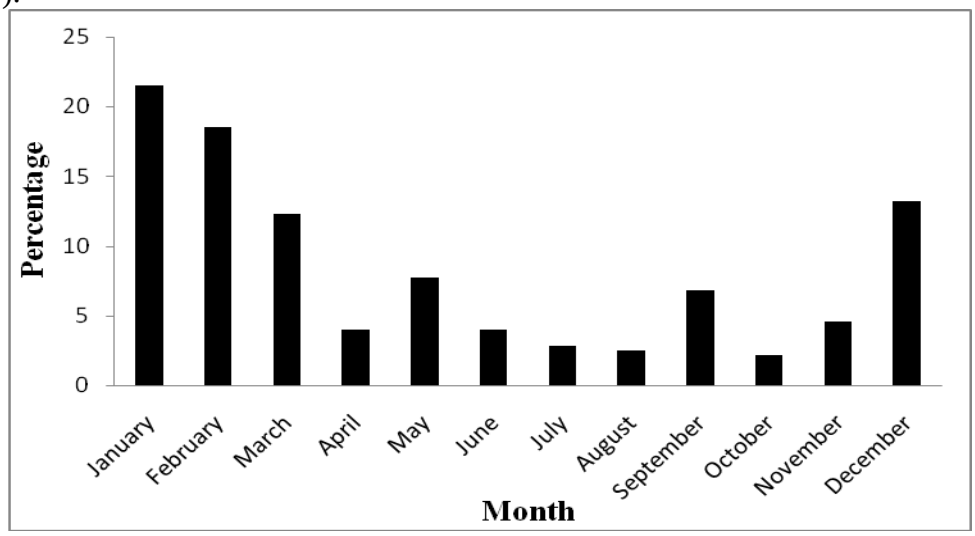

Figure 3. Distribution of acute respiratory infections in children, by month of the year.

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1.2. Non-specific pulmonary infections (tuberculosis) affecting children

- **Distribution according to age**

The results show that tuberculosis is most common in the [2 years-6 years] age group, with a percentage of 43.8%, followed by the [11 years-15 years] age group with 37.5%, and finally the [7 years-10 years] age group with 12.5%. Children under one year of age are not affected by this infection (0%) (Figure 4).

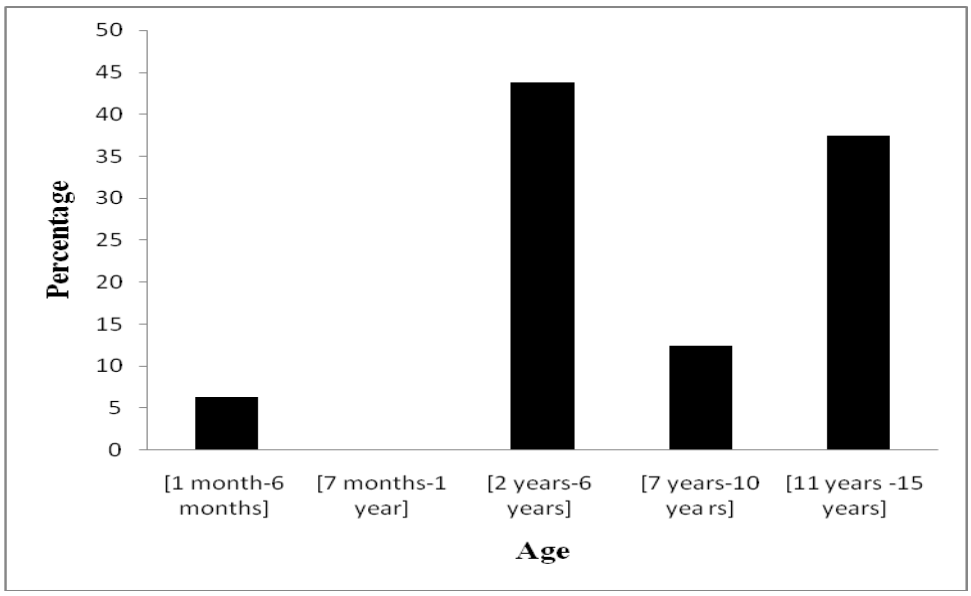

Figure 4. Distribution of tuberculosis in children according to age.

- **Distribution according to sex**

The results of the distribution of tuberculosis by sex show that female predominate, with 56.3% of cases compared with 43.8% of male, with a sex ratio of 1.3.

2. Distribution of urinary tract infections in children

- **Distribution according to age**

Urinary tract infection is a condition that varies according to age. It can occur at any age. This study shows that infants [1 month to 2 years] represent the population most affected, with a rate of 48.7% compared with other age groups (figure 5).

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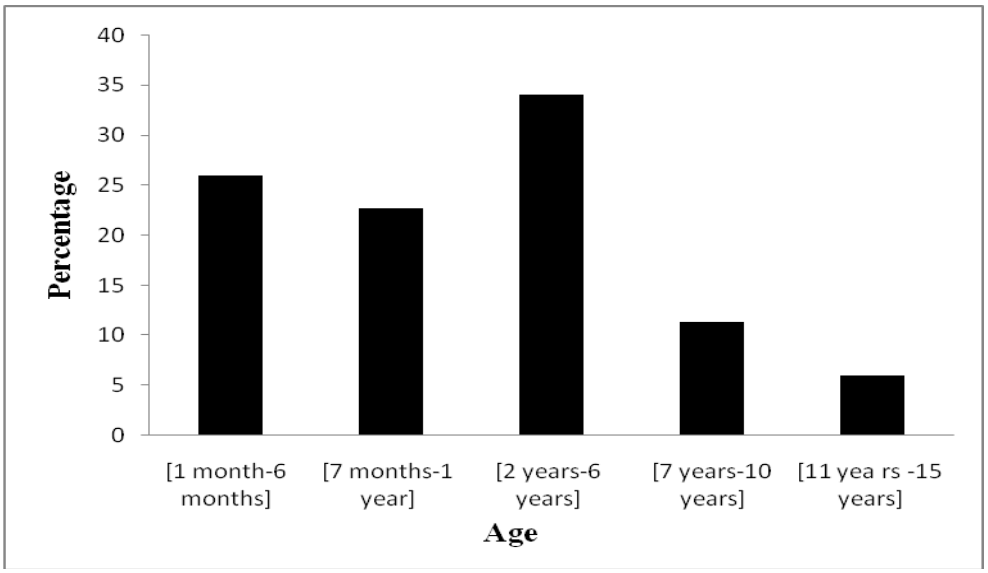

Figure 5. Age distribution of urinary tract infections affecting children.

- **Distribution according to sex**

The study involved 220 cases of urinary tract infection, including 109 boys (49.5%) and 111 girls (50.5%), with a sex ratio of 1.01 in favour of females.

- **Distribution according to the germs isolated**

A study of the distribution of urinary tract infections in children according to the microorganisms isolated reveals that *E. coli* predominates, with a rate of 40.9%, whatever the age and sex of the children, followed by *Pseudomonas sp.* (20.5%), *Klebsiella sp.* (18.2%) and *Enterobacter sp.* (11.4%). Urinary tract infections caused by *Proteus Mirabilis* were the least frequent (2.3%) (Figur 05).

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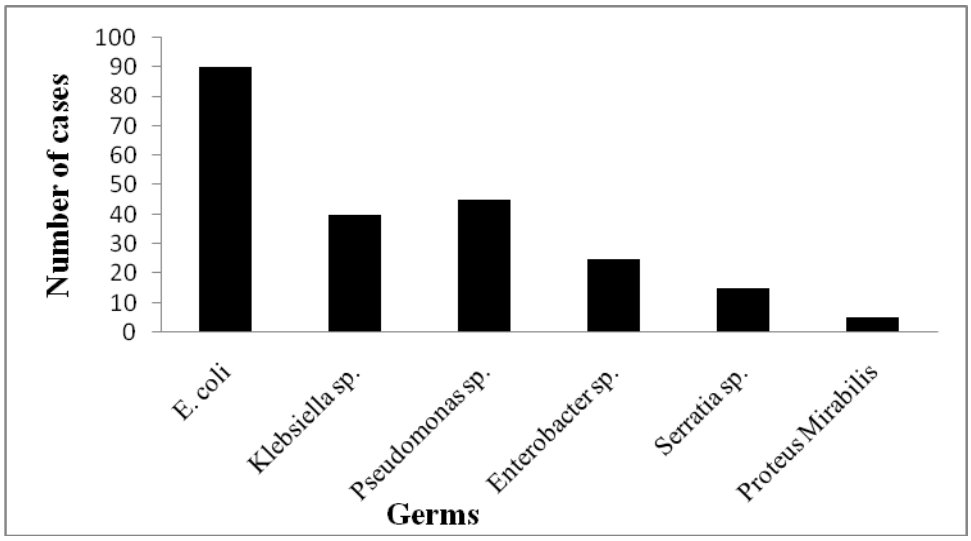

Figure. 6. Distribution of urinary tract infections in children according to the germs isolated.

3. Distribution of meningitis affecting children

➢ Distribution by type of meningitis (viral and bacterial)

The distribution of types of meningitis in children during the study period reveals that among 37 cases of meningitis recorded, 26 cases were viral, i.e. 70.3%, and 11 cases were bacterial, i.e. 29.7%.

➢ Distribution according to age

In order to reveal the importance of the disease according to age, we have divided the patients into five age groups. The evolution of cases of viral and bacterial meningitis according to age (Figure 7) shows:
[1 month - 6 months]: among e 37 cases of meningitis recorded, 5 cases (1 of bacterial origin and 4 of viral origin) belonged to this age group, i.e. approximately 13.5%;
[7 months - 1 year]: among 37 cases recorded, 5 cases (1 of bacterial origin and 4 of viral origin) belonged to this age group, i.e. approximately 13.5%;
[2 years - 6 years]: among 37 cases recorded, 14 cases (4 of bacterial origin and 10 of viral origin) belonged to this age group, i.e. approximately 37.8%;
[7 - 10 years]: among 37 cases recorded, 11 cases (5 of bacterial origin and 6 of viral origin) belonged to this age group, i.e. approximately 29.7%;
[11 - 15 years]: among 37 cases identified, 2 cases (0 of bacterial origin and 2 of viral origin) belonged to this age group, i.e. approximately 5.4%.

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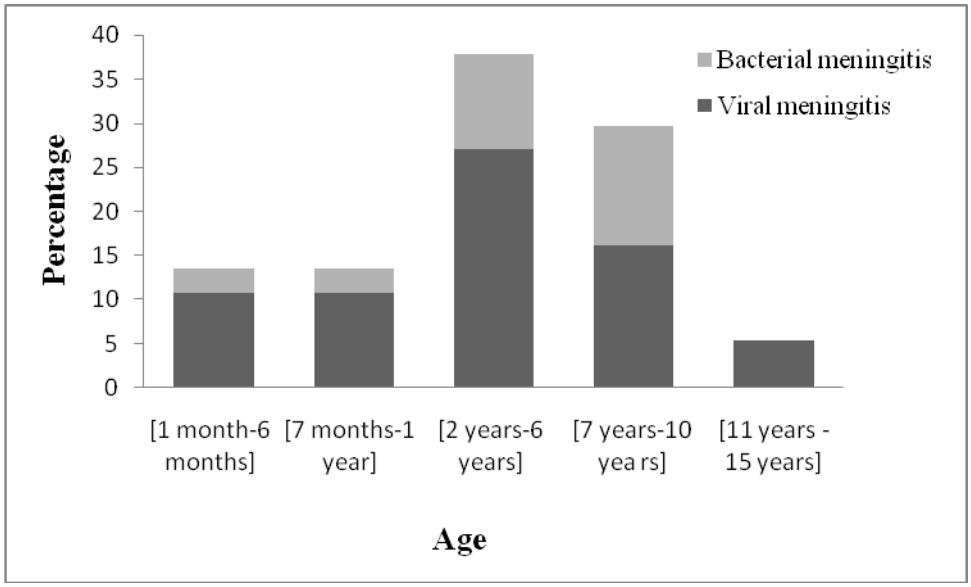

Figure 7. Distribution of viral and bacterial meningitis according to age in children

- **Distribution according to sex**

The rate of meningitis in children by sex shows a predominance of males (56.8% of cases) compared with females (43.2%), with a sex ratio of 1.3.

- **Distribution by season**

Figure 7 shows that meningitis occurs in all seasons, but with the greatest frequency in spring and summer, with 45.9% in summer and 35.1% in spring. A study of the cumulative seasonal distribution of each of the causative agents (viruses and bacteria) of the disease shows that 24.3% of viral meningitis occurs in summer and 29.7% in spring. The results for bacterial meningitis showed a different distribution, with 50% of cases occurring in spring, 30% in summer and 20% in autumn (Figure 8).

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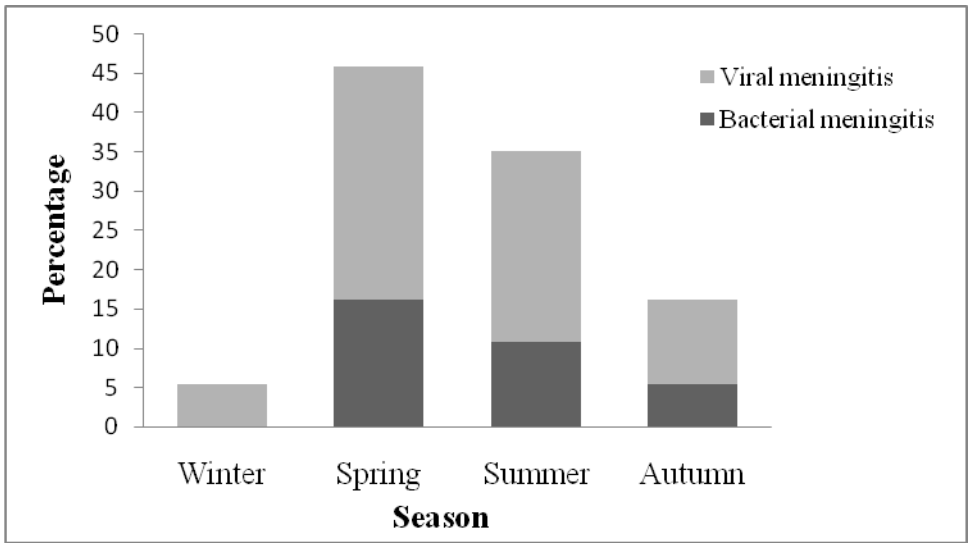

Figure 8. Seasonal distribution of cases of viral and bacterial meningitis in children.

Discussion

In this study, the most frequent infections in children were respiratory infections and urinary tract infections. This is in line with other studies (Riegel, 2003; Mohammedi, 2013). Respiratory infections represented a significant proportion of the reasons for hospitalization of children at El Mansourah hospital in Constantine during the study period (31%), with a predominance of acute respiratory infections (bronchiolitis and pneumopathy), compared with non-specific pulmonary infections (tuberculosis).

In terms of acute respiratory infections, the rate of pneumopathy recorded was low (13%) compared with the rate for bronchiolitis (87%), which could probably be explained by the use of the bacterial pneumopathy vaccine in children.

These results are similar to those obtained by Benchekroun et al. (2017), who found in their study that acute pneumonia accounted for 10.9% of hospital admissions. However, a study carried out in Mali on a series of 2,261 children hospitalized revealed a much higher rate (68.38%) of children hospitalized for acute pneumonia (Maiga et al., 2016).

In this study, the age group most affected by acute respiratory infections was [1 month-2 years], with a rate of 93.2%. Bronchiolitis was the most frequent infection. Our results are in agreement with those of Thirouin (2017) who mentioned that acute bronchiolitis affects about 1/3 of infants under two years of age, i.e. 460,000 infants each season. It is most common among infants under six months of age, and the risk of severe acute bronchiolitis is also more frequent before the age of six months. The predominance of acute respiratory infections in children aged between 1 month and 2 years could probably be explained by the fact that during the first year of life the immune system is still immature, or by the unfavourable socio-economic conditions in developing countries.

The male predominance of acute respiratory infections was evident in our study, with a sex ratio of 2.5. These results are in agreement with those in the literature (Boubakraoui et al., 2015). The latter observed in their studies conducted at the Rabat Children's Hospital in Morocco that bronchiolitis and pneumopathy were both more frequent in boys than in girls.

This male predominance is also consistent with the results of other studies where pneumopathy is predominantly male: the sex ratio was 1.2 in a study carried out by Nágoan et al. in 2012 in Côte d'Ivoire and 1.3 in Togo in an earlier study by Bakondé et al. (1998). In a study conducted at the Rabat Children's Hospital in Morocco, Benchekroun et al., 2017 noted a male predominance among children hospitalised with bronchiolitis (sex ratio of 2.18).

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Acute respiratory infections are more frequent in winter. Similar results have been observed in other studies (Bakondé et al., 1998; Ngombe et al., 2014). This result could be explained by the fact that rhinitis is fairly frequent during this period and upper respiratory tract germs are drained by nasal discharge into the infant's oropharynx. Robinson et al. (2015) showed that the season for the respiratory syncytial virus, which causes bronchiolitis, begins between November and January in Canada and lasts for four to five months.

In this study, non-specific pulmonary infections, represented by tuberculosis, were much more frequent in children over the age of two. This result could be explained by the fact that from the age of 3, children leave the family environment and increase their contacts with the outside world (immediate neighbourhood, nursery or primary school), which increases the risk of exposure to tuberculosis. The young age of the child does not increase the risk of infection, but only the risk of progression to the disease. Furthermore, the results observed in this study are different from those found by Bourrillon et al. (2014), who found that the risk of immediate progression from latent tuberculosis infection to tuberculosis disease is increased in children under 5 years (especially those under 2 years), as well as in immunocompromised children.

In addition, tuberculosis was more common among female (56.3%) than men, with a sex ratio of 1.3. These figures are identical to those obtained by Chemlal (2014) at Moulay Youssef Hospital in Rabat, who noted a female predominance of tuberculosis of 52.6%.

In second place after respiratory infections, urinary infections were the pathologies most frequently found in children, with a percentage of 20%.

Urinary tract infection is a condition that varies according to age. It can occur at any age. In this study, urinary tract infections were more frequent in infants [1 month to 2 years] than in other age groups of children. These data are in line with those obtained by Mohammedi (2013). This result could probably be explained by the increase in the number of cases of malformations of the genital tract (in males) in the infant age group [1 month to 2 years]. As well as the sudden weaning of infants, this would lead to deficiencies and malnutrition, making them more vulnerable to infections, particularly urinary tract infections (Abdoulaye, 2011).

Urinary tract infections were slightly more frequent in girls. This slight predominance of the female sex is similar to the study carried out by Sinnassamy et al. (1989) who showed that the frequency of urinary infection was 3% in girls and varied between 1 and 2% in boys, unlike the results of Binda et al. (1990) who reported that among a total of 128 children, 73 boys (57%) compared with 55 girls (43%) were affected by urinary infection. The frequency of urinary tract infections in females can be explained by the passage of germs from the urethra to the bladder. This passage is particularly easy in girls, whose urethra is short and surmounted by a sphincter that is wider than in boys (Abdoulaye, 2011).

In this study, most urinary tract infections in children are caused by *E. coli*. This corroborates the study by Mohammedi (2013) in which he mentioned that the germs responsible for urinary tract infections often belong to the natural bacterial flora, especially germs of intestinal origin, such as colibacilli (especially *Escherichia coli*, which remains the main bacterium responsible for urinary tract infections in 80% of cases). The relatively high frequency of urinary tract infections caused by *E. coli* in children can therefore be explained by the fact that this species is the most dominant in the intestinal flora and can migrate to the intestine and then to the urinary tract. In addition, *E. coli* is a faecal coliform, so improper cleaning of the intimate area can easily cause the bacteria to enter the bladder.

In this study, of the infections found in children, meningitis was the least frequent, with a rate of 3%. The results also show that viral meningitis is more common than bacterial meningitis in children hospitalized at El Mansourah Hospital in Constantine. This result seems close to that deduced by Reichart (2013), who states that viral meningitis is a frequent

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disease with an often benign prognosis, unlike bacterial meningitis. According to Cécile Plantaz (2005), viral meningitis is the leading cause of meningitis in children, accounting for 70-80% of cases, whereas bacterial meningitis is rare, accounting for 20-25% of cases.

A study of the distribution according to age reveals that bacterial and viral meningitis are observed much more in the age group [2 years - 6 years], with a predominance of meningitis of viral origin. This could probably be explained by the frequency of promiscuity (crèches and day nurseries). (2006), who stated that 79% of cases of meningitis occur at this age, mainly because of the low level of antibodies, especially in children under the age of 2. However, these results differ from those of Malouli (2006) during his study between 1999 and 2005 at the IBN-EL KATIB-Fés hospital in Morocco, where he found that infants accounted for 54% of all cases of bacterial and viral meningitis.

The distribution of meningitis in children according to sex shows a male predominance with a sex ratio of 1.3. This result seems to be close to that found by Hamam (2018) Bejaia hospital (Algeria) where he noted a male predominance in meningitis in children of 69.01%. In contrast to the previous results, a female predominance was observed in the work of Dabernat and Goulet (2000) in France. Traor (2000) and Astruc (2000) reported an almost equal distribution between the sexes in their respective studies in Mali and Morocco. In this study, viral and bacterial meningitis are more frequent in spring and summer. The resurgence of meningitis that we observed during these two seasons is already proven by the fact that meningitis is a climate-sensitive disease that develops at the height of the dry season, during which the greatest number of respiratory illnesses are observed (Martiny, 2013). The results of the cumulative seasonal distribution of viral meningitis are similar to those observed by Nahmias et al. (1990) and Shah et al. (2006), who observed an upsurge in viral meningitis in summer, due to exposure to the sun. The seasonal distribution of bacterial meningitis is relatively similar to that found by Kone (1999) and Goita (2003) in their studies of meningitis in children, which showed that bacterial meningitis occurs in all seasons but peaks in the warmer months of the year.

Conclusions

Among the infections studied in this study, respiratory infections were the most common in children, followed by urinary tract infections and meningitis. Acute respiratory infections, represented by bronchiolitis and pneumopathy, were more frequent in winter and affected more male infants. Tuberculosis, on the other hand, was more common in boys over the age of 2. Urinary tract infections were more common in female infants. The bacteriological profile of urinary tract infections was largely dominated by *Escherichia coli*. Meningitis occurred in all seasons, but was most common in spring, especially in male children over 2 years of age. The majority of cases of meningitis were of viral origin. The authors have no conflict of interest or financial involvement with any organization or entity with a financial interest, conflict, or motive which could influence the content of this manuscript. Childhood infections are a real public health problem and deserve special attention from the health authorities: parents need to be educated about the benefits of vaccination and breastfeeding so that their children can be protected against various infections. Finally, further, more detailed studies on each of the infectious diseases affecting children are needed to obtain more precise epidemiological data, which could help in the development of disease prevention strategies tailored to our context.

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