Yersinia enterocolitica - a follow-up of the outbreak in the Norwegian Armed Forces in 2014

Introduction

In the spring of 2014, there was an outbreak of gastrointestinal disease caused by the bacterium Yersinia enterocolitica (YE) in four Norwegian military camps. This was the largest outbreak ever reported in Norway,[1] where, by law, all cases of YE should be reported to the Norwegian Institute of Public Health (NIPH). The outbreak consisted of 128 cases of laboratory-confirmed infection with YE serogroup O:9, out of a total of 211 cases of YE gastroenteritis reported to the NIPH in 2014. In the 4 years prior to the outbreak (2010-2013), between 43 and 60 cases of YE gastroenteritis were reported annually, while in the 4 years following (2015-2018), between 57 and 105 cases were reported annually.[2]

YE gastroenteritis is considered a public health problem in several countries.[3] In 2017, 6823 confirmed cases were reported to the European Center for Disease Prevention and Control, making YE gastroenteritis the third most common zoonosis in the European Union.[4] YE is usually transmitted via food,[5] and a major pathway is the ingestion of infected pork products.[6,7] Moreover, in Norway and New Zealand, associations have been found between YE gastroenteritis and intake of untreated surface water.[8,9] The 2014 outbreak in the Norwegian Armed Forces was linked to the ingestion of a specific salad mix.[1]

Common symptoms of YE gastroenteritis are abdominal pain, diarrhea, and fever; nausea and vomiting are also quite frequent.[10] In adolescents, an acute terminal ileitis or mesenterial lymphadenitis may develop that can be mistaken for acute appendicitis (pseudo-appendicitis).[2] The incubation period of YE is usually between 3 and 7 days, and the onset of the disease may be more subacute than other diarrheal diseases.[11,12] A previous Norwegian study of 67 cases of

occasional YE gastroenteritis reported an average time from symptom onset to medical contact of more than 1 week, and that it took almost 2 weeks for stool samples to be taken.[8] In a German study, the symptoms of acute YE gastroenteritis lasted on average 10 days, and more than a quarter of the cases were hospitalized.[3] Other studies have found a duration of illness ranging from 12 to 22 days.[11-15]

Post-infectious complications can occur after YE gastroenteritis, the most common being erythema nodosum and reactive arthritis. Erythema nodosum is most common in women, and typically appears within a month of the first symptoms of gastroenteritis.[16] Up to 30% of adult patients develop reactive arthritis[17] several weeks after the onset of acute gastroenteritis. Reactive arthritis usually affects weight-bearing joints and may last for 3-5 months and then disappear, or it may follow a more chronic, fluctuating course.[18]

In 2018, the Norwegian Armed Forces followed up with servicepeople diagnosed with gastroenteritis during the 2014 YE outbreak. This report used the resultant, self-reported data to describe the duration of illness, the duration of any absence from service, and the incidence of symptoms of post-infectious complications in two groups of servicepeople: one diagnosed with YE gastroenteritis and the other with unspecified acute infectious gastroenteritis.

Material and method

The Norwegian Armed Forces Health Register (NAFHR) is a central health register containing data from conscripts and from military and civilian personnel in the Norwegian Armed Forces. The NAFHR incorporates data from the Norwegian Armed Forces' patient record system, its personnel system, and from internal health surveys. Data from the NAFHR is increasingly used in research that maps military service and health outcomes.

In this study, we identified everyone in the NAFHR with a recorded diagnosis of YE gastroenteritis (International Classification of Diseases (ICD) - 10 code A04.6) in the period 1 January to 30 June 2014 (n=128), all of whom were part of the outbreak. These individuals were then invited to participate in the present study. All personnel registered in the NAFHR with a diagnosis of unspecified acute infectious gastroenteritis (ICD-10 codes A04.9, A05.9, A08.4, A08.5, A09.0, A09.9) during the same period (n=323) were invited to participate as controls. In October 2018, a link to an internet-based questionnaire was distributed by e-mail to both groups (N=451), with reminders sent 1 and 2 weeks thereafter. After reading initial information about the study and giving their consent to participate, participants were asked if they remembered their episode of acute gastroenteritis during their military service in 2014. Only those who answered yes to this question were allowed to complete the questionnaire.

Figure 1

The questionnaire collected information on acute symptoms, duration of illness (1-3 days, 4-7 days, 8-12 days, ≥13 days), and duration of any absence from service due to the illness (none, 1-7 days, 8-14 days, ≥15 days). Participants were also asked to report any symptoms of post-infectious complications lasting at least 3 days during the 6 weeks following recovery from the illness or during the 6 months after termination of service in the Armed Forces. The present, mainly descriptive, study reports the number and proportion of people in the YE group and the control group. The Chi-square test was used to compare categorical data, with significance level set at 0.05.

Results

Of the 128 people with diagnosed YE gastroenteritis recorded in the NAFHR, 76 (59%) responded to the invitation e-mail, and 72 (56%, 12 women and 60 men) remembered their episode of gastroenteritis, completed the questionnaire, and were included in the YE group. Of the 323 persons

with unspecified acute infectious gastroenteritis recorded in the NAFHR, 177 (55%) responded to the invitation e-mail, and 117 people (36%, 15 women and 102 men) remembered their episode of gastroenteritis, completed the questionnaire, and were included in the control group (Figure 1). Median age in the both the YE group and the control group was 21 years and 9 months. The majority of both groups consisted of conscripts, and the majority of the study sample terminated their service in the Armed Forces between May and July 2014 (Table 1).

Table 1 Gender, age, type of service and time of termination of service for persons invited and included in the Yersinia enterocolitica (YE) group and the control group

More than half of the people in the YE group reported a duration of illness of 13 days or more, while over half of the control group recovered within 3 days. Similarly, more than 40% of the YE group had a duration of absence from service of 15 days or more, while this duration was less than 7 days for almost everyone in the control group. Diarrhea and abdominal pain were the most common symptoms experienced during the illness in both groups. Compared with the control group, a significantly higher proportion of the YE group reported pain in the lower right quadrant of the abdomen (17% versus 6%), while a significantly larger proportion of the control group reported vomiting and fever (55% vs. 8% and 37% vs. 15%, respectively) (Table 2).

There were no difference observed between the groups in symptoms of post-infectious complications during the 6 weeks after recovery. Such symptoms were reported by two women and 12 men (20%) in the YE group and five women and 19 men (20%) in the control group. In the YE group, six men and one woman (10%) reported joint pain, and four men (6%) reported joint swelling, versus six men and one woman (6%), and two men (2%), respectively in the control group (Table 2). In the YE group, there was a significantly greater proportion of officers (six people, average age 34 years and 10 months) than conscripts (eight people, average age 20 years and 6 months) who reported symptoms of post-infectious complications. In the control group, the corresponding

distribution was seven officers and 17 conscripts. None of the respondents reported symptoms of post-infectious complications in the 6 months after termination of military service.

Table 2. Duration of illness, absence from service, and symptoms in the Yersinia enterocolitica (YE) group and the control group.

Discussion

After the 2014 outbreak of YE gastroenteritis in the Norwegian Armed Forces, we found that half of those in the YE group were ill for 13 days or more, while almost all (90%) participants in the control group (i.e., with non-specific acute infectious gastroenteritis) recovered within 1 week. A Norwegian study of 67 cases of YE gastroenteritis with an average age of 23.4 years described an average duration of illness of 20 days.[11] Thus, YE gastroenteritis is a significantly more debilitating disease than a non-specific acute infectious gastroenteritis. This is also supported by our results in that 95% of respondents in the YE group remembered the episode of gastroenteritis, while this was the case in only 64% of the control group.

More people in the YE group (17%) than in the control group (6%) reported pain in the lower right quadrant of the abdomen. Pain in the lower right quadrant of the abdomen may be helpful in diagnosing YE gastroenteritis.[19,20] However, as previously described, acute YE gastroenteritis with pain in the lower right quadrant pain of the abdomen, along with fever, vomiting, leukocytosis, and mild diarrhea, can be mistaken for appendicitis.[21] With YE gastroenteritis, this symptom profile is particularly prevalent in adolescents, and may be due to the development of terminal ileitis or mesenterial lymphadenitis.[2]

In both groups, 20% reported symptoms of post-infectious complications in the 6 weeks after recovery. One in five with such symptoms in the YE group is in accordance with a German study, which found any symptom of post-infectious complications after YE gastroenteritis in 19.1% of the

participants.[22] However, in the reference group in this study, a randomly selected, age matched group, with no known gastrointestinal symptoms, 8.3% reported such symptoms. Our findings support that symptoms of post-infectious complications are quite common and show that this is the case also among young and healthy persons. The results suggest that both YE gastroenteritis and unspecified acute infectious gastroenteritis may trigger post-infectious complications to a similar degree.

In the YE group, there were no cases of erythema nodosum, but 20% reported one or more symptoms consistent with reactive arthritis. There was a higher proportion of officers than first-time service personnel reporting such symptoms. This is in agreement with the NIPH's infection control advisor, which indicates that reactive arthritis occurs in 10%-30% of cases in adults, and that post-infectious complications are most common in middle-aged and older people.[2]

One strength of this study is that we were able to investigate a large YE outbreak in a group of individuals with good underlying health. All the participants were on duty in the Norwegian Armed Forces, and the registration of the various diagnoses can therefore be considered complete.

The low response rate, especially in the control group, might raise doubts about whether these results can be considered representative of gastroenteritis cases in the Armed Forces in general. Another weakness is that the response alternatives for questions about duration of illness and duration of absence from service did not differentiate between durations longer than 2 weeks, which prevented us from recording the total duration of illness and absence.

We sent out the questionnaire more than 4 years after the episodes of acute gastroenteritis, and it is therefore likely that some of the results are affected by recall bias; moreover, cases are more likely to remember previous exposures than controls.[23] In our study, fewer respondents in the control group than in the YE group remembered their episode of gastroenteritis, and the YE group may remember illness duration and symptoms more accurately.

We asked about symptoms of possible post-infectious complications. These symptoms may be due to conditions not related to the YE gastroenteritis. Hence, there is a risk of misclassification of the symptoms reported.

Conclusion

Acute YE gastroenteritis among personnel in the Norwegian Armed Forces was associated with a longer duration of illness and longer absence from service than that resulting from unspecified acute infectious gastroenteritis. However, YE gastroenteritis was not associated with more symptoms of post-infectious complications.

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Figure legend:

Figure 1 Number of people who were invited and answered the survey