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# Clinical information on admission is insufficient to determine the appropriate isolation regimen for acute gastroenteritis

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### ABSTRACT

**INTRODUCTION:** The number of admissions for acute gastroenteritis (GE) is increasing. The majority of patients pass through a single high-flow emergency department (ED) area which increases the risk of spreading GE. The aim of this study was to determine the frequency and aetiology of GE for acutely admitted patients and to analyse their clinical information focusing on risk indicators of contagious aetiology and on the chosen isolation regime to determine if the GE required a contact precaution isolation regime. **MATERIAL AND METHODS:** This study included patients above 16 years of age who were admitted acutely within a one-year study period to a Danish hospital with a catchment population of 231,000 persons. The following items were analysed: information from the referring doctor, diarrhoea, nausea and vomiting and fever history, abdominal pain, prior antibiotics, co-morbidity, drugs, travel history, contagious contacts, general condition, vital values, isolation regime, final diagnosis and results of stool examination. **RESULTS:** Among 17,531 acute admissions, 1.6% had acute GE and 60% of these had stool examinations performed. Only 35% of the patients with GE had information about possible GE at referral. Short duration and vomiting may help to identify norovirus and antibiotic treatment within the last month to identify Clostridium difficile infections. All patients with highly infective GE were isolated under a contact precaution regime, but only one in four of the isolated patients were actually highly contagious.

**CONCLUSION:** Acute GE is a prevalent condition in the ED; a number of patients are isolated unnecessarily, but it is difficult to assess correctly who should be isolated and who should not. We recommend that further studies be undertaken to define isolation criteria and to assess the usefulness of new rapid analysis modalities with a view to reducing the isolation period.

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The incidence of admission-requiring acute gastroenteritis (GE) is increasing, mainly due to toxic *Clostridium difficile* and norovirus infections [1]. Current changes in public health care lead to a more uniform structure in which all patients are acutely referred to emergency departments (EDs). As a consequence of these changes, the majority of patients pass through the same highflow ED area. This may increase the risk of spreading communicable diseases such as acute gastroenteritis if strict isolation precautions are not implemented.

The decision concerning isolation regime should preferably be made before the patient arrives to the hospital, and any isolation should be terminated as soon as the patient is no longer suspected of being contagious. Acute gastroenteritis caused by norovirus or toxic C. difficile is highly contagious and demands a strict isolation regime with contact precautions (CP) in separate rooms with their own toilet; and the health staff needs to wear a gown, gloves and a mask. In contrast, less contagious causes of GE require only standard precautions where the patients can share a room with others, provided there is access to a separate toilet [2, 3]. Especially the CP regime decreases flexibility, restricts the patient's movement and some patients experience depression and anxiety. Furthermore, a CP regime requires more health-care worker time and leads to less documented care and fewer physician visits, particularly to the sickest patients [4-7]. CP increases the costs of health care, but is regarded as the most efficient method of preventing transmission [8, 9].

Suspicion of acute infectious GE arises when a patient suddenly starts vomiting and has frequent loose stools, often combined with fever or abdominal discomfort. Acute diarrhoea is defined as a sudden onset of loose stools more than three times daily [10]. Although the symptoms are sensitive markers for acute GE, the predictive value is low, and many other conditions must be considered. While national health authorities recommend that all patient suspected of norovirus or toxic C. difficile should be CP-isolated, they do not comment on when to suspect these infections [2]. Few guidelines on the clinical diagnosis of GE have been validated. The "Kaplan criteria" identify the probability of a norovirus outbreak and include vomiting in more than 50% of the patients, short duration of illness and negative stool samples for pathogenic bacteria [11]. These guidelines are helpful with a view to identifying a norovirus outbreak, but they are of little help when health-care staff

## ORIGINAL ARTICLE

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Dan Med J 2014;61(6):A4850 Contact precaution isolation regime.



needs to choose the right isolation regime for patients admitted to the ED.

The aim of this study was, first, to determine the frequency and aetiology of GE for acutely admitted patients and, second, to analyse the available clinical information at the time of referral for risk indicators of contagious aetiology. Third, we wished to analyse the chosen isolation regime in relation to whether the GE actually required a contact precaution isolation regime or not. This was assessed on the basis of the result of the stool examination.

### MATERIAL AND METHODS

The study was designed as a historical prospective cohort study including patients who were admitted acutely in the period from June 2012 through May 2013 to Hospital Soenderjylland is a single administrative unit, but comprised by departments in three different towns, and it has a total catchment population of around 231,000 inhabitants. The health staff had access to guidelines concerning isolation regimes for GE. All patients over 16 years of age admitted to all departments except the paediatric and obstetric department were included.

From the electronic interactive registration screen boards used in all departments receiving acute patients, we obtained information about the reason for referral. When the nurses received a telephone call from the referring doctor, a few sentences were written on the boards often combined with a group label like "presumably gastroenteritis". We electronically searched for the words "gastroenteritis", "diarrhoea" and "vomiting" including parts of the words and typing errors. If an admission with any such information was identified, we manually read the information and included the admission as a "possible GE" if this was confirmed. Patients with a history of upper or lower gastrointestinal bleeding were not regarded as possible GEs.

For all patients with "possible GE", we extracted information from the patient file concerning duration and number of diarrhoea, nausea and vomiting, history of fever, abdominal pain, mucus, pus or blood in stool, antibiotics prior to the GE, co-morbidity, number of drugs prescribed, travel history, contagious contacts, social state, general condition, blood pressure, pulse and temperature. The information was registered in a predesigned standardised electronic questionnaire.

From the patient administrative system, we received personal registration numbers, admission and discharge dates and recorded the admission department and final diagnosis for all acute admissions. The patients were considered to have a discharge diagnosis of acute gastroenteritis if the codes DA 020 to DA 059, DA 06-08, DA 090 or DA 099, DK 528 or DK 529 A to F were used according to the International Classification of Diseases (ICD-10).

We retrieved stool examination results for all acutely admitted patients from the department of microbiology, which used polymerase chain reaction (PCR) technology for analysis of norovirus and *C. difficile* toxins in addition to standard faeces cultures.

All data were merged in STATA 13 into a single data file. Categorical variables were reported in absolute numbers and percentages, and Fisher's exact test was used for testing of significance with p < 0.05 as the cutoff point. The analytic unit was number of admissions, which means that a patient might appear more than once in the database.

The study was a quality assurance study of the hospital isolation routines with no contact to the patients, and thus no ethical approval was required. The study was registered by the Danish Data Protection Agency.

Trial registration: not relevant.

## RESULTS

In all, there were 17,531 acute admissions during the one-year observation period, 53% medical, 17% surgical and 2% orthopaedic admissions, whereas 28% were not confined to a specialty. In **Table 1**, the basic information shows that among all acute admissions, 584 patients (3.3%) had information concerning "possible GE" already on referral and 1.6% of the admissions resulted in the final diagnosis acute infectious GE, of whom 99 (35%) had the information of "possible GE" at the time of referral. The median age of patients who had a final diagnosis of acute GE was 69 years (p25-p75: 45-83 years), and 57% were females.

"possible gastroenteritis"

		% of total			Positive	
	n	admissions	variable	Total, n	n %	
Total acute admissions						
Admissions	17,531					
Admissions with stool sample for GE aetiology	563	3.2				
Admissions with GE as final diagnosis	284	1.6				
Admissions with GE as final diagnosis and stool examination	167	1.0	59			
Admissions with GE as final diagnosis and stool examination						
and a verified highly <sup>a</sup> infectious agent in stools	68	0.4	41			
Patients with "possible GE" on referral time						
Admissions	584	3.3				
Admissions with stool sample for GE aetiology	147	0.8				
Admissions with GE as final diagnosis	99	0.6	17			
Admissions with GE as final diagnosis and stool examination	60	0.3	61			
Admissions with GE as final diagnosis and stool examination						
and a verified highly <sup>a</sup> infectious agent in stools	21	0.1	35			
Results of stool sample analysis for all admissions						
PCR identification method:						
Norovirus				214	59	27.6
Toxic Clostridium difficile				370	34	9.2
Faeces culture method:				508	25	4.9
Campylobacter jejuni					12	2.4
Campylobacter species					7	1.4
Salmonella typhi					1	0.2
S. Typhimurium					1	0.2
C. difficile					4	0.8

a) Norovirus or toxic C. difficile infection.

In 3.2% of the acute admissions, stools were analysed for pathogenic virus or bacteria. Among the admissions with a final diagnosis of infectious GE, a stool examination was performed in 59%. In 41% of the stool samples, a highly infectious agent, i.e. toxic C. difficile or norovirus infection, was revealed.

Acute GE was significantly more prevalent in admissions to medical than to surgical departments (2.2% versus 1.3%, p: 0.02). Stool samples were examined significantly more often in medical admissions than in surgical admissions (67% versus 43%, p: 0.004), and they more frequently revealed highly infectious cases of GE (45% versus 12%, p; 0.009).

Only 17% of the patients with "possible GE" at the referral time received a final infectious GE diagnosis. Stools were examined in 25% of these admissions, and 14% were highly contagious. Table 2 shows some of the analysed clinical variables for the patients with "possible GE" who had a stool examination performed. Many variables were not recorded in all the patient files. The variables number of diarrhoea, nausea, history of fever, abdominal pain, mucus, pus or blood in stool, co-morbidity, number of drugs prescribed, travel history, contagious contacts, social state, general condition, blood

pressure, pulse and temperature were not useful for discrimination between norovirus or C. difficile infection, on the one hand, and other diagnosis with diarrhoea, on the other hand; but a history of vomiting and symptoms for less than three days in norovirus infection and treatment with antibiotics within the past month in C. difficile infection were significantly more common than in other patients who had a possible infectious GE on admission.

The chosen isolation level was only recorded in 37 of the 147 "possible GE" admissions with a stool examination. Contact precautions were maintained in all cases that later revealed either norovirus or C. difficile infection, whereas 83-85% of the admissions without these aetiologies also had a contact precaution isolation regime, e.g. one in three to four of the CP isolated patients were in need of isolation. CP isolation was maintained in more than 24 hours in 59% of these admissions.

### DISCUSSION

We found that 1.6% of all acute admissions recorded during the one-year study period were registered with a final diagnosis of acute GE, but only around 60% of these patients had a stool examination performed. Only 35% of the patients whose final diagnosis was GE had infor-

### TABLE 2

History of gastroenteritis symptoms on referral and result of stool examination.

	Examination f	Examination for norovirus infection					Examination for toxic Clostridium difficile infection					
	norovirus infe	norovirus infection		other diagnosis <sup>b</sup>		toxic C. difficile infection		other diagnosis <sup>b</sup>				
History and clinical signs	N (n with available information)	%	N (n with available information)	%	p-value	N (n with available information)	%	N (n with available information)	%	p-value		
Classic GE symptoms <sup>a</sup>	2 (12)	17	16 (54)	30	0.49	5 (9)	56	29 (93)	31	0.16		
Symptom duration < 3 days	8 (12)	67	17 (54)	31	0.04	1 (9)	11	32 (93)	34	0.27		
History of vomiting	12 (12)	100	17 (54)	31	0.03	4 (9)	44	25 (93)	27	0.27		
< 5 times diarrhoea on admission day	0 (12)	0	8 (54)	13	0.33	2 (9)	22	14 (93)	15	0.63		
History of fever	3 (3)	100	11 (19)	58	0.27	1 (3)	33	25 (33)	76	0.12		
Abdominal pain	4 (5)	80	18 (27)	67	1.0	3 (5)	60	29 (39)	74	0.60		
Chronic diseases	10 (11)	91	39 (45)	87	1.00	9 (9)	100	60 (74)	81	0.35		
Antibiotic treatment with last month	1 (12)	8	8 (54)	15	1.0	5 (9)	56	10 (93)	11	0.03		
Systolic blood pressure < 100 mmHg	0 (12)	0	8 (54)	15	0.33	3 (9)	33	7 (93)	8	0.04		
Pulse > 100/min.	5 (12)	42	16 (54)	46	0.50	1 (9)	11	37 (93)	40	0.15		
Temperature > 38.5 °C	6 (12)	50	18 (54)	33	0.33	4 (9)	44	36 (93)	39	0.74		
Isolation regime												
Contact precaution isolation regime	5 (5)	100	17 (20)	85	1.0	5 (5)	100	19 (23)	83	1.0		
GE = gastroenteritis.												

a) GE symptoms: sudden onset and  $\geq$  3 loose stools per day.

b) Other final diagnosis apart from noro and C. difficile infection, explaining the GE symptoms on admission.

mation about "possible GE" at the time of referral. Short duration and vomiting may help identify patients with norovirus infection and a history of antibiotic treatment *C. difficile* infections. Whereas all patients with highly infective GE were isolated under a contact precaution regime, only one in three to four of the isolated patients were actually highly contagious.

Surprisingly little is known about the clinical epidemiology of acute GE at the hospital level [12, 13]. The finding of 1.6% of acute admissions with a final diagnosis of acute GE was very similar to findings from ED in the US where 1.5% were discharged with this diagnosis [14], but another study indicated an increasing trend especially due to more norovirus and *C. difficile* infections [15].

The low frequency of collected stool samples among patients suspected for acute GE on admission is also reported elsewhere [16]. Even in epidemic situations, it was difficult to obtain stool collection rates exceeding 25%; and in a well-conducted prospective survey, a definite aetiology was possible only in 50% of the cases [17, 18]. The low collection rates may be due to the fact that it is inconvenient to collect stool samples or that patients are unable to provide samples after arrival. Furthermore, the examination results are only available some days after the collection, and their clinical consequence is often limited. This may discourage the health staff from collecting the specimens [13].

Few other studies have searched for risk factors to discriminate between the different aetiologies of acute

GE at the hospital level. One study found that norovirus subjects had more vomiting and a known exposure than other aetiologies, but the relation was too weak to be used clinically [13]. A study of *C. difficile* infections indicated that patients with a toxic *C. difficile* more frequently had a history of previous antibiotics, were more clinically ill and had a higher leucocyte count than other *C. difficile* patients without the toxins [19].

Whereas several studies emphasise the importance of contact precautions, we found no study which assessed how many patients could have avoided strict isolation regimes based on the microbiological results.

Since the present evidence indicates that contact precaution is important in confining the spreading of infectious GE but has several adverse implications including increasing costs [7-9], our study identifies several aspects that should beconsidered.

Infectious GE is a quite common condition in EDs. Only one third of the patients will have information before arrival that alerts the health staff to consider isolation regimes. It seems that all patients with highly contagious aetiologies are isolated accordingly, but this produces a high number of unnessecary isolations. However, there is presently sparse evidence-based clinical information that can help clinicians identify those patients who need isolation upon their arrival to the ED. Prospective, systematically collected data on this aspect are warranted.

Whereas collection of stool samples will not reduce the initial number of patients who are isolated, it may shorten their isolation period. Presently, new PCR technologies for analysis of the most contagious aetiologies are emerging, and efficacy studies using these technologies as a means of reducing isolation time are requested [20]. Since the stool specimen collection rate is low, the procedure needs attention. One way to secure early collection is to use rectal swabs rather than waiting for spontaneus defecation [13].

This study has some important limitations. It is based on historical data, recorded for clinical use, i.e. not for the present study. In the journal auditing part, this resulted in limited information on some of the examined variables. The number of examined stool samples was low compared with the number of patients ending up with acute GE. Since there was no systematic recording of whether a patient was isolated or not, the degree of isolation might have been higher than the study reflects.

Furthermore, in the majority of cases, the final GE diagnosis was neither based on stool examination nor on strict definitions of GE, but only on the discharging physician's judgment. It is remarkable that despite information about possible GE at referral time, only a minority had stool examinations performed. The study was not designed to investigate if the GE suspicion was rejected with good explanations and thus did not require further investigations, or if GE was actually spreading from the suspected patients.

### CONCLUSION

Our findings indicate that it is difficult to assess whom to isolate. Future studies should systematically collect clinical information to define isolation criteria and assess the usefulness of the new rapid analysis technologies in reducing the isolation period.

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