Journal Article

Are local guidelines on investigations in children admitted with acute gastroenteritis being adhered to?

Francesca Galea, Marija Agius, Stephanie Mifsud, David Pace

Abstract

Aim: To assess adherence to local guidelines on the investigation of children admitted with acute gastroenteritis.

Method: Children admitted to Mater Dei Hospital with a diagnosis of gastroenteritis between December 2012 and February 2013 were selected. Their investigations were retrospectively assessed in relation to the degree of dehydration and the type of management given. Hospital guidelines relating to investigations performed in children admitted with gastroenteritis were reviewed and compliance was assessed.

Results: A total of 411 investigations were carried out in 76 children with the most common investigations being serum electrolytes, urea and creatinine and random blood glucose. Guidelines were met in 4/76 (5.3%) of the study population. Serum electrolytes had the greatest impact on management.

Conclusion: The local guideline on gastroenteritis is not being adhered to in the vast majority of cases. There is an urgent need to raise awareness about the availability and utilisation of this guideline amongst doctors working in paediatrics.

Francesca Galea MD *
Basic Specialist Trainee 2
Department of Child and Adolescent Health
Mater Dei Hospital
Msida, Malta
francesca.a.galea@gov.mt

Marija Agius MD, MRCS (Edin) MSc (Edin)
Basic specialist Trainee 2
Department of Surgery
Mater Dei Hospital
Visiting assistant lecturer at the University of Malta
Msida, Malta

Stephanie Mifsud B.Sc (Hons), MD
Basic Specialist Trainee 1
Department of Anaesthesia
Mater Dei Hospital
Msida, Malta

David Pace MD, PgDip PID (Oxf), FRCPCH
Consultant Infectious Disease Paediatrician
Department of Child & Adolescent Health
Mater Dei Hospital
Msida, Malta

**Corresponding Author*

Key words

Gastroenteritis, Paediatric, Dehydration, Electrolytes.

Introduction

Acute gastroenteritis is defined as the occurence of at least 3 episodes of loose watery stool and/or at least 2 episodes of vomiting in the preceeding 24 hours. [1] It is a common, usually self limiting, easily transmissible disease.[2] The commonest causes are viral pathogens with Rotavirus being identified as the leading cause of childhood gastroenteritis across the world especially in children under the age of five years.[3,4] Gastrointestinal fluid losses place children at risk of dehydration, with clinical signs usually being apparent when 3 - 5% of the body weight is lost. Investigation of such patients is based upon clinical judgement and guidance provided by available protocols. This retrospective observational study was performed to asssess adherence to the local guideline defining investigations and management of children admitted with acute gastroenteritis.

Methods

This was a retrospective observational study; the list of patients used was obtained from the register at the Paediatric Accident and Emergency Department at Mater Dei Hospital where the demographic data and provisional diagnosis of patients admitted to the paediatric medical wards are documented. The study cohort consisted of all children aged from 0-<16 years of age admitted between 1st December 2012 - 28th February 2013. All the children who were documented as having 'gastroenteritis', 'gastritis', 'vomiting' or 'diarrhoea' as the reason for admission were included. The case notes, discharge letters and online results of all these patients were retrieved and evaluated and those who were found to have had another primary diagnosis or who did not meet the diagnostic criteria for gastroenteritis were excluded. The latter criteria were obtained from the local guideline where gastroenteritis is defined as "the

occurrence of at least 3 episodes of loose watery stools and/or at least 2 episodes of vomiting in the previous 24 hours".[1]

Patient demographics, percentage of dehydration, investigations done, results and any change in management were documented. The percentage dehydration was either found written in the case notes, calculated from the IVI rate or else based on observations documented by the examining doctor. These observations included an assessment of skin turgor, urine output and state of hydration of mucous membranes. These data were then used to determine whether local guidelines on investigation of children admitted with acute gastroenteritis were adhered to and if not, whether there was a particular reason for doing so. The guideline was accessed via the paediatric database available on the local hospital's intranet[1]. The reference ranges of the results were adapted to the study population. [5]

Results

There were 83 eligible admissions over the twelve week study period. Of these, 7 subjects were excluded due to incomplete or missing data. Of the 76 children included in the study, 55.3% were females and their ages ranged from 0.03 - 15.8 years (mean of 4.39 years). The number of subjects who exhibited clinically inapparent dehydration (0-3%) was 48 (63.2%); 26 individuals (34.2%) had mild to moderate dehydration (>3-8%), and 2 individuals (2.6%) had severe dehydration (>8%) (Table 1).

Four children did not require any investigations. A total of 411 investigations were carried out in the remaining 72 children, as shown in Table 2. The investigations that were most frequently requested were: serum electrolytes in 92.1% (70/76), serum creatinine in 92.1% (70/76), serum urea in 90.7% (69/76), complete blood count (CBC) in 82.9% (63/76), random blood glucose in 60.5%, (46/76) CRP in 28.9% (22/76) and stool cultures in 25% (19/76). The percentage of deranged results was as follows; CBC in 55.6% (35/63), serum urea in 21.7% (15/69), serum electrolytes in 12.9% (9/70), serum creatinine in 11.4% (8/70), random blood glucose (RBG) in 21.7% (10/46) and C-Reactive Protein in 22.7% (5/22). No microorganisms were cultured from blood cultures, stool cultures or urine cultures when taken. Enzyme immuonassay (EIA) for rotavirus on stool was positive only in one child.

The majority of abnormalities in the CBC consisted of minor deviations from the normal ranges of white blood cell, haemoglobin or platelet count. These were not considered to be clinically significant and had no effect on any of the patients' management. All the deranged blood glucose results were due to hypoglycaemia (<3 mmol/l) however this did not affect the type or rate of intravenous infusion which always contained 5% dextrose (in saline) and which resulted in correction of the hypoglycaemia by the time the result of the blood glucose was available. Abnormal creatinine result impacted management in one case; the creatinine was elevated and a decision was made to keep the patient on intravenous rehydration until the creatinine normalised. Hypokalaemia was detected in 3 cases; hyponatraemia in 4 cases and hyperkalaemia in 2 cases. Serum chloride was low in 1 case. Management was affected in 40% (4/10) of cases. In three cases this was through the addition of potassium supplements to the intravenous fluid to correct hypokalaemia and in one case serum electrolytes were repeated following detection of hyponatraemia on the initial result. No changes in management were effected in the other 6 cases.

The results of microbiological investigations performed on stool speciments were all available after patient discharge and did not affect managment. Thirty stool investigations were ordered in all, including stool for the presence of parasites, EIA for rotavirus, stool cultures for the detection of *C.difficile* toxin. Of these only one result was positive and this was to rotavirus.

A comparison of the investigations taken with those stated in the local guidelines on gastroenteritis in children, available since 2007, showed that the guidelines were completely adhered to in **5.3% (4/76)** of the study population.

Table 1: *Investigations performed in children admitted with different degrees of dehydration*

Percentage dehydration	Number of individuals	No investigations done	Only serum electrolytes taken	Other investigations taken in addition to serum electrolytes	Guidelines met
0-3%	48	4	0	44	4
>3-8%	26	0	0	26	0
>8%	2	0	0	2	0

Table 2*: Total number of investigations taken and impact of abnormal results on management*

Investigation	**Total**	**Abnormal (%)**	**Change in management (%)**
Biochemistry			
Urea	69	15 (21.7)	0
Electrolytes	70	10 (14.3)	4 (40.0)
Creatinine	70	8 (11.4)	1 (12.5)
Random blood glucose	46	10 (21.7)	0
Calcium and phosphate	3	1 (33.3)	0
Liver function tests	2	0	0
Venous blood gas	2	0	0
Haematology			
Complete blood count	63	35 (55.6)	0
Coagulation screen	2	0	0
Blood picture	2	2 (100)	0
Immunology			
C-Reactive Protein	22	5 (22.7)	0
Coeliac screen	2	0	0
Thyroid Function Tests	1	0	0
Microbiology			
Stool for parasites	1	0	0
EIA for Rotavirus	8	1 (12.5)	0
Stool cultures	19	0	0
C.difficile toxin	2	0	0
Urinalysis and microscopy	9	0	0
Urine culture	9	0	0
Respiratory screen	1	1 (100)	0
Blood cultures	2	0	0
Imaging			
Chest X-ray	5	0	0
Abdominal X-Ray	1	0	0
Total	**411**	**87**	**5**

Discussion

The aim of this study was to audit local practices on the investigations taken in patients admitted from paediatric casualty with a diagnosis of acute gastroenteritis. Specificially, adherence to local guidelines was assessesed in order to follow on a similar audit carried out in St Luke's Hospital in 2000 looking at routine investigations in acute paediatric admissions.[6] The latter study had suggested an alteration in practice so that investigations be restricted to routine electrolytes alone in those with mild/moderate gastroenteritis.[6]. This then led to the formulation of the current departmental guidelines.[1]

Local guidelines state that in patients with 0-3% dehydration, no investigations are indicated and in patients with mild-moderate dehydration (>3-8%) initiated on intravenous fluids only serum electrolytes need to be taken. In the case of individuals with severe dehydration (>8%) it is advised to take CBC, urea, electrolytes and creatinine, CRP, RBG, venous blood gases (VBGs) and blood cultures.[1] This position is similar to that taken by the National Institute of Clinical

Excellence (NICE) and endorsed by the Royal College of Paediatrics and Child Health (RCPCH) in a guideline published in 2009 relating to diarrhoea and vomiting in children under 5 years of age [7]. The latter guideline was issued 2 years after publication of the local guidelines. However while both guidelines agree over the exclusion of CBC from the panel of investigations where dehydration is mild to moderate, the NICE guidleines suggest that in addition to the serum electrolytes; plasma creatinine, urea and glucose should also be taken if the child is to be started on IVI. [7]

The population of 76 children studied in this audit is larger than that studied in the apriori mentioned audit where the gastroenteritis subgroup was composed of 45 children;[6] this can be attributed to the fact that the time period of data collection was expanded from 6 weeks in the previous study to 3 months in our study.

The guideline on gastroenteritis was followed only in 4 children (5.3%) all of whom had 0-3% dehydration and were started on oral rehydration solution (ORS) without any investigations being taken. In the remaining cases, other investigations in addition to the recommended electrolytes were taken in individuals having percentage dehydration between 0-8%.

With the introduction of iCM (online patient investigation requisition software) and the resultant replacement of hand written blood investigation requests by electronic ones, many doctors ordered a renal function test which incorporates measurement of urea, electrolytes and creatinine automatically in one request. The latter fact however would still not explain the reason why the number of investigations is so high since with the exception of 5 cases; other investigations were taken in addition to a renal function test and the percentage of individuals in whom solely a renal function test was ordered would still be low at 11.8%.

There were no cases in which only electrolytes were ordered; despite the fact that a separate request can be found online on the iCM software. In one case, creatinine and electrolyes were ordered but urea omitted from the panel of investigations.

Of note is that a blood picture result was given in two cases; in both cases the blood picture was reported as showing thalassaemic indices. This was probably an incidental finding; as the lab will automatically work out a blood picture if CBC indices are abnormal; in fact; no documented request for such an investigation was found in the patient notes. However this result did not seem to have a bearing on management as both iCM and the patient notes showed no further investigations or documentation in relation to the abnormal blood picture.

A total of 30 stool investigations were ordered in all including stool for culture and sensitivity, stool for *Clostridum difficile* and EIA for rotavirus. Although the results had no immediate bearing on initial managment they are important for subsequent managment from a public health surveillance point of view.

With regards to the 'extra' investigations in two cases on whom a CXR was taken, the patients in question were documented as having fever and a productive cough; one patient within the 0-3% dehydration subgroup, in whom CBC and VBGs, were taken was documented as being an insulin dependent diabetic. Urinalysis and microscopy and urine culture were requested on another child who was febrile and whose mother had reported a foul smelling urine. This could argue for the fact that the clinican deviated from guidelines in view of the specific clinical circumstances where other pathologies were suspected in addition to gastroenteritis. The results of the additional investigations performed on these two children were all normal and did not impact management.

While acknowledging the fact that patient investigations and managment are also guided by the clinical picture and personal judgement of the assessing clinician, the large number of additional investigations indicates that investigations are being ordered 'routinely' rather than because there is a specific clinical indication to do so. One of the major reasons could be that there is a lack of awareness that such guidelines exist, leading doctors to order a CBC 'routinely' because this is a commonly used investigations. Another reason could be that doctors may decide that once there is a patent cannula in place that is allowing blood letting; one should send bloods for more than one investigation 'just in case' without actual justification for ordering a particular test.

Conclusion

From this retrospective observational study it was concluded that despite availability of local guidelines explaining which investigations should be taken in children admitted with gastroenteritis adherence is poor at 5.3% with additional investigations being requested even though the results do not have any subsequent bearing on patient managment. There is a dire need to raise awareness amongst doctors working in the paediatric department on the availability of guidelines on the mangement of acute gastroenteritis. Adherence to these guidelines will result in a reduction in the amount of unnecessary investigations that are currently being requested on children and a cost saving to the hospital.

References

1. Pace D, Attard Montalto S. Guidelines in the management of acute gastroenteritis in children. 2007. Available at: MDH Intranet.
2. Lopman BA, Reacher MH, Duijnhoven YV, Hanon FX, Brown D, Koopmans M. Viral Gastroenteritis Outbreaks in Europe, 1995-2000. Emerg Infect Dis. 2003; Vol9, No.1 (90-6).

3. Cortese MM - Parasha UD. Prevention of Rotavirus Gastroenteritis among infants and children. Recommendations of the Advisory committee on Immunisation Practices (ACIP). Moribidity and Mortality weekly report. 2009; 58 (RR02); 1-25.
4. Hall GV, Kirk MD, Ashbolt R, Stafford R, Lalor K, OzFoodNet Working Group. Frequency of infectious gastrointestinal illness in Australia, 2002: regional, seasonal and demographic variation. Epidemiol Infect. 2006; 134, 111-118.
5. Kliegman RM, Stanton B, St. Geme J, Schor N, Behrman RE. Nelson Textbook of Pediatrics, 19th ed. Philadelphia: Elsevier, Saunders; 2011.
6. Pace D, Said Conti V, Attard Montaldo S. Are routine investigations in acute paediatric admissions justified? MMJ. 2007; Vol. 19 Issue 02:18-22.
7. National Institute for Health and Clinical Excellence (NICE) (2009). Diarrhoea and vomiting caused by gastroenteritis: diagnosis, assessment and management in children younger than 5 years. [CG84]. Available at: www.nice.org.uk/CG84. (Accessed 24/2/2015).