

Astrovirus as a Cause of Gastroenteritis in Infants and Children

Thesis

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Dedication

I dedicate this work to my
Great love my father, my
mother whom left our
world waiting this moment,
to my husband who was
always beside me, to my
sisters, my friends
my Children and every
child all over the world
with my love and wishes to
see their smile

List of contents

▪ Introduction	١
▪ Hypothesis and Aim of the Work	٣
▪ Review:	
– Chapter-١	٤
– Chapter-٢	٣٣
– Chapter-٣	٤٢
▪ Subjects and methods	٦٤
▪ Results	٧٢
▪ Discussion	٨٤
▪ Concolusion	٩٣
▪ Recommendation	٩٤
▪ Summary	٩٥
▪ Appendix	٩٧
▪ References	١٠٢
▪ Arabic summary	_____

List of Tables

Title	Page
Table (١): Pathogenesis of diarrhea	١١
Table (٢): Pathophysiologic classification of diarrhea	١٣
Table (٣): Etiologic classification of diarrhea.....	١٦
Table (٤): Clinical features of acute infectious gastroenteritis	١٨
Table (٥): Extra intestinal manifestation of enteric Infections	٢١
Table (٦): Composition of fluids for intravenous and oral rehydration in acute gastroenteritis.....	٢٣
Table (٧): Assesment of severity of dehydration	٢٤
Table (٨): ORS Calculation of maintenance fluid requirements	٢٥
Table (٩): Agents of viral gastroenteritis	٣٣
Table (١٠): Description of patient's general characteristics	٧١
Table (١١): Description of presenting symptoms of the studied cases	٧٣
Table (١٢): Prevalence of astrovirus among the studied cases according to the ELISA results.....	٧٣
Table (١٣): Comparison between negative and positive groups as regards age of the studied cases	٧٤

Table (١٤): Comparison between negative and positive groups as regards gender of the studied cases.....	
Table (١٥): Comparison between negative and positive groups as regards socioeconomic level of the studied cases	٧٥
Table (١٦): Comparison between negative and positive groups as regards head circumference percentile	٧٥
Table (١٧): Comparison between negative and positive groups as regards height percentile	٧٦
Table (١٨): Comparison between negative and positive groups as regards weight percentile	٧٦
Table (١٩): Comparison between negative and positive groups as regards presenting symptoms (vomiting).....	٧٧
Table (٢٠) Comparisn between negative and positive groups regards presenting symptpms (fever)	
Table (٢١): Comparison between negative and positive groups as regards presenting symptoms (abdominal colic).....	٧٨
Table (٢٢): Relation between feeding and astrovirus	٧٨
Table (٢٣): Relation between season and astrovirus.....	٧٨

List of Figures

Fig. No.	Page
Fig. (١): Absorption and secretion of electrolytes and water by intestinal epithelium	٨
Fig(٢): Mechanisms of absorption and secretion of electrolytes and water in the small bowel epithelium	٩
Fig (٣): Classification of Small round viruses	٤٣
Fig (٤): Astrovirus morphology	٤٤
Fig (٥): Feeding and infection.....	٧٩
Fig (٦): Relation between season and infection.....	٧٩
Fig (٧): Type of feeding	٨٠
Fig (٨): Astrovirus positivity.....	٨١
Fig (٩): Relation between age and astrovirus	٨١
Fig (١٠): Relation between gender and infection.....	٨٢
Fig (١١): Relation between HC and infection	٨٢
Fig (١٢): Relation between vomiting and infection	٨٣

List of Abbreviations

ACIP..... Advisory committee on immunization practice

CHO Carbohydrate

DIFT Direct immunofluorescent test

ECF..... Extracellular fluid

EIA Enzyme linked immunoassay

ELISA.... Enzyme linked immunosorbent assay

EM Electric microscopy

EPEC..... Enteropathogenic Escherichia coli

ETEC.... enterotoxigenic Escherichia coli

GIT Gastrointestinal tract

HAstv.... Human astrovirus

HIV Human immunodeficiency virus

IEM..... Immunoelectric microscopy

IgA Immunoglobulin-A

IgG..... Immunoglobulin G

IIF Indirect immunofluorescent test

MAbs Monoclonal antibodies

mRNA.... Messenger RNA

ORFs..... Open reading frames

ORS Oral rehydration solution

RIA Radioimmunoassay

RT-PCR Reverse transcriptase polymerase chain reaction

SCFAs.... Short chain fatty acids

SRSVs.... Small round structured viruses

SRVs..... Small round viruses

VIP..... Vasoactive intestinal peptide

WBC White blood cell

WHO World health organization

INTRODUCTION

Acute gastroenteritis is a major source of morbidity and mortality among young children in developed and developing countries (*Oh et al.*, ۲۰۰۳).

Gastroenteritis (also known as gastric flu, and stomach flu although unrelated to influenza) refers to inflammation of the gastrointestinal tract, involving both the stomach and the small intestine and resulting in acute diarrhea. The inflammation is caused most often by infection with certain viruses, less often by bacteria or their toxins, parasites, or adverse reaction to something in the diet or medication. Worldwide, inadequate treatment of gastroenteritis kills ۰ to ۸ million people per year, and is a leading cause of death among infants and children under ۰ (*Wikipedia*, ۲۰۰۸).

Among viral agents causing gastroenteritis, human Astrovirus take second or third place after Rota virus and Calici virus as the most frequent causes of illness (*Espul et al.*, ۲۰۰۴). Astrovirus is a small strand RNA virus, it is water born that has an endemic level of digestive morbidity in the general population (*Komorya et al.*, ۲۰۰۳).

Human astrovirus was first discovered in the stool of the children with gastroenteritis and characterized by electron microscopy in ۱۹۷۰ (*Putzker et al.*, ۲۰۰۰). Astrovirus is about

۲۷-۳۴ nm in diameter, it was given its name for the characteristic five to six point star shape detected by electron microscopy after staining of fecal extract (*Bass and Qui, ۲۰۰۰*).

Hypothesis And AIM OF THE WORK

Etiology of gastroenteritis is not definite in more than half of the cases. So, recent researches are studying new etiological agents. Hence, the aim of this study was to determine the prevalence of astrovirus as a cause of gastroenteritis in Egyptian children.

Gastroenteritis

Definition:

Gastroenteritis is a condition that causes irritation and inflammation of the GIT (the pathway responsible for digestion that include the mouth, esophagus, stomach and intestines (*Benjamin, ٢٠٠٦*).

Signs and symptoms of gastroenteritis

The main symptom is diarrhea but it may be accompanied by nausea, vomiting and/ or crampy abdominal pain (*Arthur, ٢٠٠٨*).

Diarrhea

Diarrhea is a problem not only of the developing world, but also of the western world. However the economic implication of diarrheal diseases are particularly evident in the poorer countries (*Farthing et al., ٢٠٠٠*)

Diarrhea in children accounts for approximately ٥ million deaths per year in the developing world. In United States, diarrhea accounts for ١٠% of all outpatient visits and ١٤ hospital admissions per ١٠٠٠ children each year younger than one year of age (*Ghishan et al., ٢٠٠٨*)

Diarrhea is an important cause of malnutrition, this is because patients with diarrhea eat less and their ability to

absorb nutrient requirements is reduced, moreover their nutrient requirements are increased as a result of the infection. Each episode of diarrhea contributes to malnutrition. When episodes are prolonged their impact on growth is increased (*WHO, 1990a*).

Definition

Vanderhoof (1999) defined diarrhea as the excessive loss of stool water and electrolyte. In infants, stool volume more than 10 gm/kg/24 h is considered diarrhea. Whereas by three years of age, stool output greater than 200 gm/24 h is considered diarrhea.

In breast fed infant who normally passes several soft or semi liquid stools each day, it is practical to define diarrhea as an increase in stool frequency or liquidity that is considered abnormal by the mother. On the other hand, greenish motion without change in stool consistency is not considered diarrhea and is of no significance (*NCDDP, 1997*).

A diarrheal day was defined as the occurrence of ≥ 3 unformed stools (or ≥ 1 if bloody) in a 24 h period (*Naficy et al., 2000*)

Classification

Diarrheal diseases can be classified in various ways:

The first major subdivisions are acute, chronic and persistent Diarrhea (*Farthing et al., ٢٠٠٠*).

Acute diarrhea implies a sudden onset, generally over hours rather than days and duration of less than one week, chronic diarrhea is generally of more gradual onset and lasts more than one to two weeks, whereas persistent diarrhea refers to diarrheal episodes of presumed infectious etiology that begins acutely but have an unusual long duration often more than fourteen days (*WHO., ١٩٩٩ and Bhan et al., ١٩٩٦*).

Pathophysiology:

Absorption of water from the small intestine is caused by osmotic gradient which is created when solutes (particularly sodium) are actively absorbed from the bowel lumen by the villous epithelial cells (Fig.١). There are several mechanisms whereby sodium is absorbed in the small intestine (Fig.٢). To enter the epithelial cells, sodium is linked to the absorption of chloride ion or absorbed directly as sodium ion or exchanged for hydrogen ion or linked to the absorption of organic substances such as glucose or certain amino acids. The addition of glucose to an electrolyte solution can increase sodium

absorption in the small intestine as much as three folds (*WHO, 1990a*).

After being absorbed, sodium is transported out of the epithelial cells by an ion pump referred to as $\text{Na}^+ \text{K}^+ \text{ATPase}$. This transfers sodium into the extracellular fluid (ECF) elevating its osmolarity and causing water and other electrolytes to flow passively from the small bowel lumen through intercellular channels and into the ECF (Fig. 5). This process maintains an osmotic balance between fluid in the bowel lumen and the ECF (*WHO, 1990a*).

