Journal of Pediatric Surgery 53 (2018) 335–338

Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jpedsurg

Serum intestinal fatty-acid binding protein: predictor of bowel necrosis in pediatric intussusception☆,☆☆

Adesoji Ademuyiwa [a,b], Felix Alakaloko [b,*], Olumide Elebute [b], Christopher Bode [a,b], Ifeoma Udenze [c]

[a] Paediatric Surgery Unit, Department of Surgery, College of Medicine, University of Lagos
[b] Department of Surgery, Lagos University Teaching Hospital, Lagos, Nigeria
[c] Department of Chemical Pathology, College of Medicine, University of Lagos, Nigeria

ARTICLE INFO

Article history:
Received 2 November 2017
Accepted 8 November 2017

Key words:
Pediatric intussusception
I-FABP
Biomarker
Bowel necrosis

ABSTRACT

Background/purpose: Serum Intestinal Fatty-Acid Binding Protein (I-FABP) is a useful marker of bowel necrosis in pediatric intussusception. The aim of this study is to determine the sensitivity of this marker and correlate it with length of necrosed small bowel.

Methods: A single-centre prospective study of 50 children presenting to Lagos University Teaching Hospital, Nigeria, in whom a diagnosis of intussusception was made over 1 year was completed. Additionally, 25 age- and sex-matched controls (day case surgery) were recruited. They were grouped into three: 25 children with necrotic bowel, 25 without bowel necrosis, and 25 controls. The serum IFABP levels were compared between the cohorts with confirmed bowel necrosis at surgery and those with no necrosis, as well as controls. The cut-off values for the diagnosis of bowel necrosis were calculated using a receiver operating characteristic curve (ROC). The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated.

Results: Twenty-five children were diagnosed with necrotic intussusception whose serum IFABP immunoassay has significantly higher median compared with those without necrosis and controls (2056.0 ng/ml vs. 943.0 ng/ml and 478.0 ng/ml $P = 0.0002$). Using a cut-off value of 1538 ng/ml, the sensitivity, specificity, PPV, and NPV were 64%, 88%, 84%, and 71%, respectively. I-FABP titer greater than 1538 ng/ml was found to have higher likelihood of necrotic bowel ($p = 0.002$; odds ratio 13.04; 95% confidence interval; 0.618–0.891).

Conclusion: Serum I-FABP is moderately sensitive for discriminating between bowel necrosis, and it predicts increased likelihood of bowel resectability in intussusception.

Level of evidence: Level II – Development of diagnostic criteria in a consecutive series of patients and a universally applied "gold standard".

Idiopathic intussusception is the commonest cause of intestinal obstruction in childhood [1]. In most low and middle-income countries, the condition is associated with high morbidity and mortality [2]. Some of the reasons responsible for the poorer outcomes include delayed presentation or missed diagnosis (by primary physicians) and delay in surgical intervention due to financial constraints [3]. A significant cause of delay occurs in peripheral hospitals where patients with bloody stools are routinely managed as a case of bacterial or amoebic dysentery with antibiotics and fluid replacement therapy. Such avoidable delays may be eliminated if there was a marker to differentiate intussusception from such differential diagnosis.

Intestinal fatty acid binding protein (I-FABP) is found in the cytoplasm of intestinal (duodenum to ileum) mucosal cells and colonic mucosa. The molecular mass is about 15 kDa [4]. It is a cytosolic protein with a low molecular mass and has a specific localization in the intestinal epithelium. These attributes make I-FABP a potentially beneficial blood marker for the diagnosis of small bowel disease, obstructions and even evolving vascular complication of intussusception. It is released into the blood stream when enterocytes undergo apoptosis and can subsequently be detected in the serum [5]. The aim of this study is to evaluate the usefulness of serum I-FABP as a sensitive marker for bowel necrosis in intussusception.

1. Materials and methods

This was a prospective comparative study carried out at the Pediatric Surgery Unit of the Lagos University Teaching Hospital in collaboration with Department of Chemical Pathology. The study period was for 12

☆ **Financial support and sponsorship:** Nil
☆☆ **Conflicts of interest:** None declared.
* Corresponding author at: Department of Surgery, Lagos University Teaching Hospital, P.M.B 12003, Surulere, Lagos, Nigeria. Tel.: +234 8034056897.
E-mail address: felixalakaloko@gmail.com (F. Alakaloko).

https://doi.org/10.1016/j.jpedsurg.2017.11.028
0022-3468/

calendar months. Approval for the study was obtained from the Research and Ethics Committee of Lagos University Teaching Hospital. Informed consent was obtained from each of the parents or guardians of all patients that participated in the study. The blood specimens obtained were sent to the laboratory for storage and pooled for analyses by the Chemical Pathologist. The resected tissues were sent for histopathological evaluation to confirm bowel necrosis.

1.1. Subjects

Patients enrolled in the study were children aged 0-15 years of consenting parents or guardians who presented to the children emergency with clinical and radiological features of intestinal obstruction from intussusception during the study period. Age- and sex-matched controls were also recruited from pediatric day case surgery. Non-Nigerian children or mixed-race children, patients with previous abdominal surgery or congenital intestinal obstruction and those whose parents did not consent were excluded from the study.

1.1.1. Intraoperative assessment of bowel

Intraoperative findings were documented precisely, and the length of necrosed segment of bowel noted. Bowel was assessed as necrotic if its appearance was dusky, flabby to touch with no arterial pulsations or peristalsis even after flicking the bowel or application of warm packs with 100% oxygen. The length of necrosed segment of bowel was measured by using the string attached to a standard abdominal pack to score the extent of the necrosed segment of bowel and then measured against a sterile metallic calibrated ruler, which is re-sterilized with the instruments tray after each use.

Patients were allocated into three different groups – the necrotic bowel group (NBG) – for patients with features of intussusception and confirmed at surgery to have bowel necrosis; the non-necrosis bowel group (NNBG) – patients with intussusception without bowel necrosis and control group (CG) – patients recruited from day case surgery without features of intestinal obstruction or intussusception.

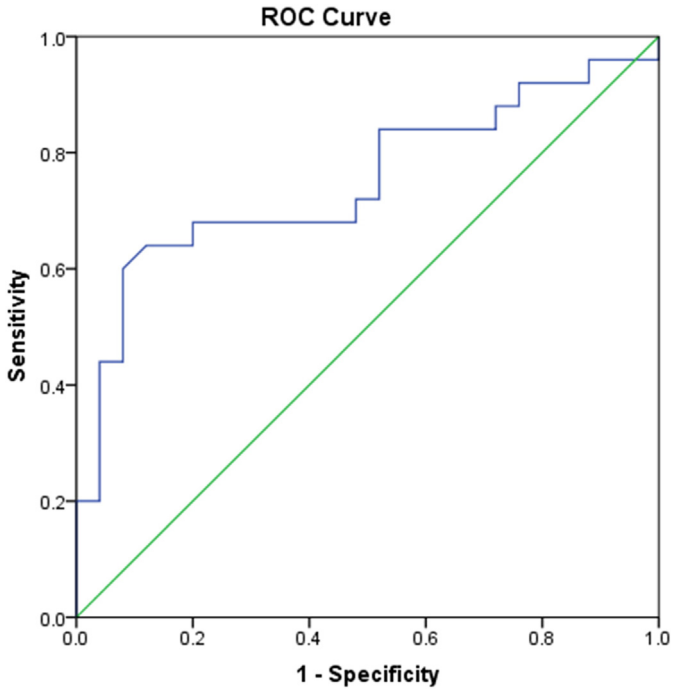

Fig. 2. Receiver operator characteristic curve (ROC) for serum Intestinal fatty acid binding protein in pediatric intussusception. AUROC = 0.75.

1.1.2. Laboratory technique and materials

An enzyme linked immunobsorbent serologic assay (ELISA) kit, Hycult biotech ELISA kit was used (Hycult Biotech Inc. The Netherland), for quantitative determination of I-FABP in serum and read out using Emax® micro tube well reader.

Three milliliters of blood were collected from recruited patients and then centrifuged at a 4 °C to separate the serum which was then stored

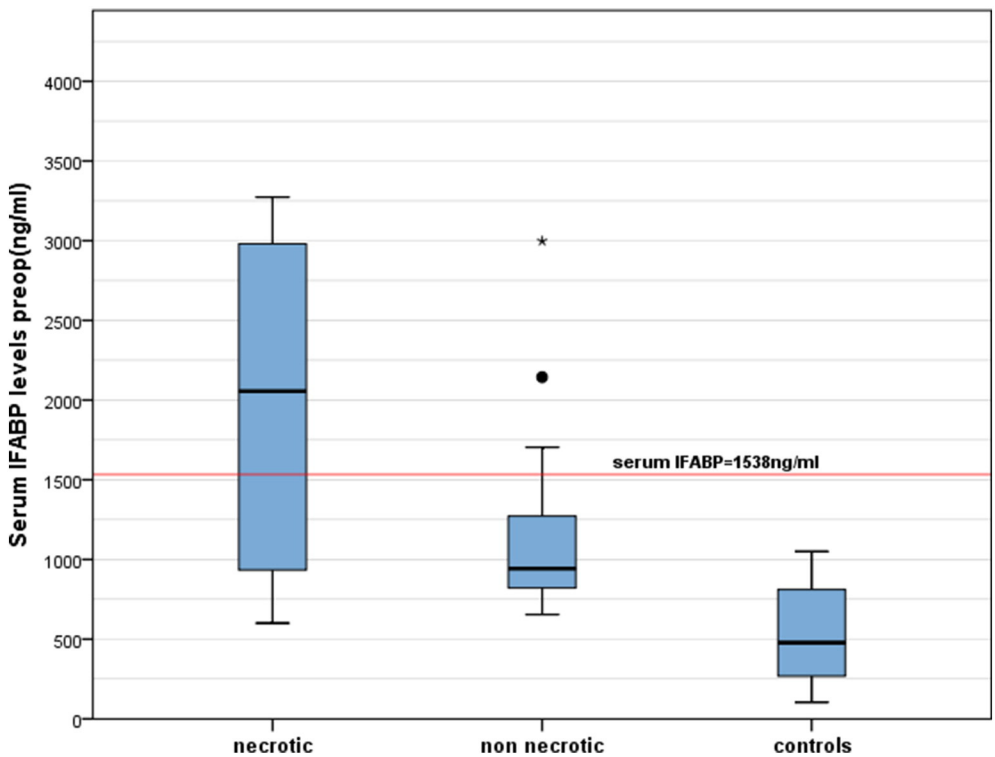

Fig. 1. Distribution of serum Intestinal fatty acid binding protein (I-FABP) levels with their interquartile ranges among necrotic, non-necrotic and control groups.