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Clinical versus laboratory parameters for prediction of disease progression in surgical necrotizing enterocolitis

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Abstract

Aim: To evaluate our experience in management of surgical^{NEC} and whether clinical or laboratory parameter can predict the progression of disease in surgical NEC

Patient and methods: Retrospective study was cared on 30 patients with surgical necrotizing enterocolitis in the form of abdominal wall erythema, positive paracentesis, abdominal lump and bowel perforation were included, patients developing enterocolitis after surgery were excluded. The patients were evaluated with clinical, laboratory and radiological parameters. These include age at presentation, stage, symptoms and sign at presentation with laboratory parameters of blood counts, pH, base deficit, platelet counts, electrolytes and random blood sugar levels. A comparison was done between clinical and laboratory parameters, and between survival and non survival patients and also between operated and non operated patients.

Results: There were 25 males and 5 females patients with mean birth weight of 1.9 kg. Age at presentation ranged from 3 to 20 days (mean: 9.3 days). Mortality was 33.3%. The neonates with severe disease had abdominal distention with wall erythema. 43.3% of patients had shock at the time of presentation, also it was observed that neonates with acidosis and higher base deficit and had progressive fall in platelets counts had more chance of requirement of laparotomy. There was no statistical difference in birth weight, gestational age, total leukocyte count, serum electrolytes, blood sugar and other measured parameters. Also neonate not presenting with shock were more likely to survive.

Conclusion: Clinical parameter assessment still remains the best to predict the disease progression in surgical necrotizing enterocolitis.

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INTRODUCTION

Necrotizing enterocolitis (NEC) is an acquired disease of the gastrointestinal tract that affects premature neonates in 90% of cases, with improvement of prenatal and neonatal care in the past two decades, more and more premature and critically ill neonates are surviving, therefore, the number of cases of ENC is increasing (1). It is becoming the commonest neonatal surgical emergency. The risk factors are prematurity and low birth weight with their inherit immaturity of body systems including the pulmonary, gastrointestinal, and immune systems (2). Secondary risk factors are prematurity and early feeding of these neonates, especially feeding with hyperosmolar formulas. The diagnosis of the NEC become an easy task with the awareness of the disease and its commonly used triad of abdominal distention, intolerance to feedings, and increased gastric aspirate with or without bloody stools and with or without pneumatosis intestinalis (3). Various clinical and laboratory parameters used to decide surgical interventions in cases of NEC, surgical intervention is only indicated in about 40 to 50% of cases, depending upon

the criteria used (4). Identifications of such criteria can predict the progression of the disease need for laparotomy in cases managed with peritoneal drainage and ultimate outcome of patient. And also add a new dimension to the existing management protocol and helps in early recognition of deteriorating patient (5)

Patients and methods:

The study was retrospectively carried out at the department of pediatric surgery in Zagazig university hospitals from January 2008 to December 2009. 30 patients were admitted during this time were included in the study. They had clinically proven diagnosis of surgical NEC and fulfilled one or more criteria of surgical NEC in the form of clinical or radiological evidence of bowel perforation, positive paracentesis, abdominal wall erythema indicating bowel gangrene, presence of abdominal lump and patients not responding to conservative management with falling general condition. Patients with post operative NEC were excluded from the study.

The patients qualified for the study were evaluated with clinical, laboratory and radiological parameters. The clinical parameters include gestational age, birth weight, and modified Bell's stage of the disease at time of presentations. The laboratory parameters include serial blood count, platelet count, electrolytes, blood PH, base deficit, blood culture, and random blood sugar levels. The radiological parameters include serial abdominal x-ray taken at 12-hour intervals. Comparison was done from the data collected between (1) patients with primary peritoneal drainage versus patients with peritoneal drainage followed by laparotomy, (2) operated versus non-operated patients (3) Bell's stage 2 versus stage 3 patients (4) survivors and non-survivors. Survivor was defined by patients who were alive at one month post discharge from the hospital.

Statistical analysis:

The data collected were analyzed using mean standard deviation (SD) for continuous data and percentages for categorical data. To compare two groups for categorical data, chi-square test was used. While for comparison of continuous data, Mann-Whitney test was used. $p < 0.05$ was considered statistically significant.

Result:

The demographic counts were as follows. There were 25 males (83.3%) and 5 females (16.7%). Birth weight was in range 1-3.5 kg (mean 1.9 kg). Age at presentation ranged from 3 to 20 days (mean 9.3 days). Mean age for presentation for preterm patients was 9.1 days, while for full term patients was 9 days. Gestational age at time of presentations was 28 to 41 weeks (mean 34.12 weeks). The majority of patients had presented with feed intolerance and abdominal distention. The patients with severe disease had abdominal distention with wall erythema. 50% of patients presented by shock at the time of admission. 5 of 30 patients were treated conservatively without any drain, they initially showed features of abdominal wall erythema and distention, they were stable and had good general condition, they were observed to improve in 48 hours.

The clinical data of patients managed by PD versus PD followed by laparotomy was compared, to give idea based on the parameters observed whether we can predict the need for laparotomy in patients managed by PD. Patients who required laparotomy following peritoneal drain, had lower PH ($P=0.059$) and higher base deficit ($P=0.39$), they also had progressive fall in platelet counts but I did not reach to statistical significance ($p=0.373$) due to small sample size. There was no difference in birth weight, gestational age, total leukocyte count, serum Na^+ and random blood sugar levels. Presence of shock at presentation, presence of positive blood culture. In our study we studied laboratory parameters to see there was difference in any parameter between operated and conservatively managed patients. All patients who were operated were found to have either intestinal gangrene or perforation. And there is progressive increase in total leukocyte count, progressive fall in platelet count and PH were observed in operated cases. No significant difference in serum Na^+ and blood glucose level between two groups.

In our study there is 20 survivors and 10 non-survivors (table 3) the survivor had higher mean birth weight ($p=0.650$) and gestational age ($p=0.105$) as compared with non-survivor but there is no statistical significance may be due to small sample size. 80% of non-survivor patients were presented by shock as compared with 25% in the survivor group. But there is statistical significance between the two groups, which include PH ($P=0.03$), base deficit ($p=0.02$), and number of patients presented with shock ($p=0.002$). Patients who died remained more acidotic and had higher base deficit as compared with survivor. Laboratory parameters were studied to predict the progression of the disease (table 4) in which there is correlation between Bell's stage II and stage III in which there is severe decrease in the platelet count in stage III with progression of the disease and there is higher base deficit in stage III. There is no difference in other laboratory parameter between two stages.

Table (1): correlations of parameters between patients managed with peritoneal drain only and patients requiring salvage laparotomy.

	P D only (n=20)	P D + LAP (n=5)	P value
Gestational age	34.2±5	34.03±1.7	0.653
Age at presentation (wks)	10.5±4	5.7±5	0.273
Birth weight (kg)	1.8±0.5	2.05±0.2	0.253
Total leukocyte count	11.300±5.200	13.500±6.200	0.256
Platelet concentration	125.125±80.600	60.500±60.500	0.372
P H	7.3±0.05	7.22±0.12	0.0592
Serum Na+	137.6.5±6.7	135±8.5	0.621
Base deficit	6.2±2.5	11±4.5	0.0332
Random blood sugar	115±20	110±15	0.951
Positive blood culture	10 (33.3%)	2 (40%)	1.000
Shock	7 (35%)	2 (40%)	1.000

Table (2): comparison between operated and non operated patients

	Operated (n=10)	Non operated (n=20)	P value
Platelet concentration	80.750±22.700	125.600±80.200	-0.432
Total leukocyte count	15.300±3.200	10.500±2.500	0.085
Serum Na+	132±8.3	137±6.1	0.231
P H	7.2±0.07	7.33±0.06	0.142
Base deficit	8.6±4.3	6.5±3.7	0.261
Random blood sugar	105±30.5	110.5±25	0.653
Survival	5 (50%)	15 (75%)	0.103

Table (3):-correlations of parameters between survivor and non survivor.

	Survivor (n=20)	Non survivor (10)	P value
Gestational age (wks)	36.5±4.3	33.3±4.02	0.105
Birth weight (kg)	1.9±0.56	1.75±0.7	0.650
Total leukocyte count	11.500±5.700	13.300±5.100	0.521
Platelet concentration	129.200±80.500	90.600±56.500	0.214
P H	7.3±0.05	7.2±0.10	0.003
Base deficit	5.21±2.4	11.23±4.2	0.002
Random blood sugar	98.5±27.43	115.4±27.2	0.120
Positive blood c/s	10(33.3)	5 (50%)	0.321
Shock	5 (25%)	8 (80%)	0.002
Stage II	7 (35%)	0	0.132
Stage III	13(65%)	10 (100%)	

Table (4): laboratory parameters to predict the progression of the disease in NEC

	Stage II(n=7)	Stage III (n=23)	
Platelet concentration	179.000±60,500	105.000±65,000	0.051
Total leukocyte count	10,500±2,700	12,000±5,200	0.76
Na+	134±5.2	135±7.0	0.381
Base deficit	3.3±2.5	8.2±4.3	0.122
Random blood sugar	90±15.4	110±25.4	0.124
P H	7.3±0.32	7.25±0.09	0.023
Survived	7 (100%)	13 (56.5%)	0.123

Discussion:

NEC is the most common gastrointestinal medical and /or surgical emergency occurring in neonates. It accounts for 1-5 of nursery admission (6). The advances in modern neonatal intensive care units have resulted in better survival of both term and preterm infants. As a result of improved survival in low birth weight babies the incidence of NEC has increased (7). NEC continues to present a diagnostic challenge to clinicians. Especially, early detection of intestinal necrosis requiring surgical treatment is still a key problem. The initial clinical manifestations of NEC

are non specific and indistinguishable from other gastrointestinal disorders and sepsis (8) we conducted a retrospective study in our pediatric surgical unit to know whether clinical or laboratory parameters can predict the progression of the disease in surgical NEC patients .and to know which patient need for peritoneal drain and patient required laparotomy and salvage surgery. Extensive studies have been done in the past regarding the severity indices and monitoring of NEC patients who are treated conservatively (9). In our study ,the patients managed by peritoneal drainage was 20(66.6%) and patient managed by peritoneal drainage and followed by laparotomy was 5 patients (16.6%) there is no significant difference between two groups in gestational age ,age at presentations ,and birth weight .but there statistical significance in P H and base deficit , in which patients managed by laparotomy more acidotic and with higher base deficient . In other series the favorable course in a patient with NEC with perforation managed with PD is to have a controlled fistula which gradually resolves over a period of time (10) in our study there is comparison between operated and non operated groups of surgical NEC ,in which 20 patients not operated and 10 patients was operated ,the operated patients was more acidotic and with higher base deficit ,5 patients (50%) from operated patients was survived and 15 patients (75%)from non operated group was survived ,also there higher increase in platelets concentration and decrease in total leukocyte count in non operated group , there is no significant deference in random blood sugar in both groups. Random blood sugar may be normal, elevated or decrease in NEC.This depend on the degree of the sepsis. Few studies report that random blood sugar decrease in patient with positive blood culture with G-negative bacilli,other cases of normoglycemia seen in patients with mixed infections and patient with hyperglycemia is seen in patients with E-coli sepsis (11). In our study we do comparison between survivor and non survivor patients ,in which 20 patients (66.7%) was survived and 10 patients (33.3%) non survived . non survived patients had lower birth weight and lower gestational age but without statistical significance .5 patients (25%) from survived group was presented by shock and 8 patients (80%),in other series presentation of shock was (23.5%) in survivor and (90%) in non survivor ,this means that presentation of shock is a grave prognostic factor for progression of the disease, also non survivor group more acidotic with higher base deficit . in the present series comparison was done between laboratory parameters of Bell's stage II and Bell's stage III ,in which bell's stage III had lower PH , higher base deficit and high total leukocyte count .Bell's stage II had higher platelet concentration. All patients with Bell's stage II was survived but only (56.5%) of Bell's stage III was survived .these results are compatible with results of other series. Mitul parikh (5), showed that 100% of patients with Bell's stage II was survived and 54.5% of Bell's stageIII was survived. Overall no single laboratory parameter can predict the progression of the disease in NEC but clinical parameters associated with laboratory parameters can give a good idea about progression of the disease in NEC. Recently there is non invasive markers (intestinal fatty acid binding protein I-FABP) which can diagnose and predict progression of the disease in NEC (12) but still under trial.

Conclusion:

There is no single parameter can predict the progression of the disease in surgical NEC. And clinical parameters assessment still remains the best to predict the disease progression in surgical necrotizing enterocolitis .

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