

Is transfer of surgically risk necrotizing enterocolitis to tertiary center is important from the start?

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ABSTRACT

Background: Necrotizing enterocolitis (NEC) is common devastating inflammatory intestinal disorder of newborns with multisystem organ failure. Disease progression affects about half of all affected infants, in case of surgical interference the mortality rates exceeding 30%. Until now hospital transfer of surgical necrotizing enterocolitis to centers with specialized pediatric surgical expertise remains a dilemma for pediatricians and pediatric surgeons. **Objective:** compare the mortality and morbidity of infants with surgical risk NEC managed in centers with surgical facilities with similar infants in centers with no surgical facilities. **Methods:** all neonates suffering from surgically risk necrotizing enterocolitis (Modified Bell's Staging, stage IIB & Stage IIIA) in Qena university hospital and Three pediatric centers in Qena are divided into two group:- Group A: (26 neonates in Qena university hospital). -Group B:(37 neonates in the three pediatric centers) **Results:** As regard to patients, both group are similar in age at presentation, sex, gestational age, residence, weight, presenting manifestations. neonates in group (B) had more hospital stay 50.14 ± 13.98 ($p < 0.001$), in the other hand more neonates in group (A) need surgical intervention 35.35 ± 9.83 ($p = 0.003$) with nearly similar outcome as regard mortality in both groups. The length of hospital stay were more among died neonates in both groups, the group (A) ($p=0.024$) and the group (B) ($p=0.04$). there was significant correlation between mortality and surgical intervention in the group (B) ($p=0.021$). **Conclusions:** There is no significant difference as regard to mortality of neonates with surgical risk NEC managed in centers with surgical facilities compared with similar neonates in centers with no surgical facilities, also more cooperation between pediatric surgeons and pediatrician in our locality have positive implication in the introduction of good care for neonates with NEC.

Keywords: Necrotizing enterocolitis, tertiary center, Neonatal Intensive Care Units

INTRODUCTION

Necrotizing enterocolitis (NEC) is common devastating inflammatory intestinal disorder of newborns with multisystem organ failure^[1, 2]

NEC remains a major cause of mortality, the damage to bowel ranging from mucosal injury to full-thickness necrosis and perforation^[3-6]

Many cases of NEC are managed medically, but roughly 20% to 40% of patients require surgical intervention^[7-11].

Disease progression affects about half of all affected infants, in case of surgical interference the mortality rates exceeding 30%^[6,12]

Non specific presenting symptoms and deficient of qualified pediatricians lead to defect in diagnosis and subsequently reluctant in transfer

to higher levels of care^[12,13]. variations in treatment strategies and levels of care may lead to affection of outcome between NICUs (Neonatal Intensive Care Units) , and this affect the different center which seek to improve outcomes^[14,15]. Until now hospital transfer of surgical necrotizing enterocolitis to centers with specialized pediatric surgical expertise remains a dilemma for pediatricians and pediatric surgeons. Studies show low mortality of surgical NEC in centers with high level of surgical resources^[16,17]. In contrast other studies show mortality of infants with surgical NEC isn't affected when transferred for centers with higher level of surgical care^[18,19].

The goal of this study was to compare the mortality and morbidity of infants with surgical risk NEC managed in centers with surgical

facilities with similar infants in centers with no surgical facilities

PATIENTS AND METHODS

Study design:

Hospital based observational cohort study.

Qena has one tertiary center providing neonatal surgical facilities. Neonates needing surgical intervention from three pediatric centers were transported to Qena university hospital. The three centers have well qualified trained neonatologists in attendance full time and have visiting pediatric surgeons from the Qena university hospital for consultation

During the study period June 2015 – June 2018 all neonates suffering from surgically risk necrotizing enterocolitis (Modified Bell's Staging, stage IIB & Stage IIIA) in Qena university hospital and the three centers are divided into two group:-

- Group A: (26 neonates in Qena university hospital).
- Group B:(37 neonates in the three centers)

Exclusion criteria

1. Centers with no qualified trained neonatologists in attendance full time.
2. Centers with no ventilators.
3. Incomplete data about the patient.

Patients' data: Age at presentation, sex, gestational age, residence, weight, presenting manifestations (hypotension, bleeding, sepsis,

vomiting, poor feeding, abdominal distension, hypoxia)

Laboratory data:Routine investigations were done for all included neonates.

White blood cell count, Serum CRP ,Blood culture was done on all included neonates with suspected sepsis

Outcomes compared included hospital stay, operation and mortality

RESULTS

All 63 neonates suffering from surgically risk necrotizing enterocolitis (Modified Bell's Staging Stage IIB & Stage IIIA) during the study period, 26 neonates in Qena university hospital where there are surgical facilities (group A) and 37 in three centers without surgical facilities(group B). The two groups were similar as regard to patients and hospital outcome.

As regard to patients, both group are similar in age at presentation, sex, gestational age, residence, weight, presenting manifestations (hypotension, bleeding, sepsis, vomiting, Poor feeding, abdominal distension, hypoxia)(fig.1) and Laboratory data (Leukocytosis & CRP) (Table 1).

Neonates in group (B) had more hospital stay 50.14 ± 13.98 ($p < 0.001$), in the other hand more neonates in group (A) need surgical intervention 35.35 ± 9.83 ($p = 0.003$) with nearly similar outcome as regard mortality in both groups (Table 2).

Table (1): Demographic and clinical data of the included patients:

	Group A (n= 26)		Group B(n= 37)		P-value
	No.	%	No.	%	
Sex:					
Male	14	53.8%	21	56.8%	0.819
Female	12	46.2%	16	43.2%	
Gestational age: (weeks)					0.788
Mean \pm SD	33.46 \pm 2.96		33.30 \pm 2.22		
Median (Range)	32.5 (30.0 – 40.0)		33.0 (30.0 – 40.0)		
Residence:					0.596
Rural	13	50.0%	21	56.8%	
Urban	13	50.0%	16	43.2%	
Weight/ gm (Mean \pm SD)					0.705
Mean \pm SD	2169.23 \pm 464.56		2089.19 \pm 324.71		
Median (Range)	2050 (1500-3000)		2000 (1500-2900)		
Presenting manifestations:					
Hypotension	21	80.8%	30	81.1%	1.000
Bleeding	14	53.8%	20	54.1%	0.987
Sepsis	10	38.5%	20	54.1%	0.222
Vomiting	17	65.4%	22	59.5%	0.634
Poor feeding	20	76.9%	26	70.3%	0.558
Abdominal distension	22	84.6%	31	83.8%	1.000
Hypoxia	6	23.1%	11	29.7%	0.558
Laboratory data:					
Leukocytosis	19	73.1%	27	73.0%	0.993
CRP	24	92.3%	34	91.9%	1.000

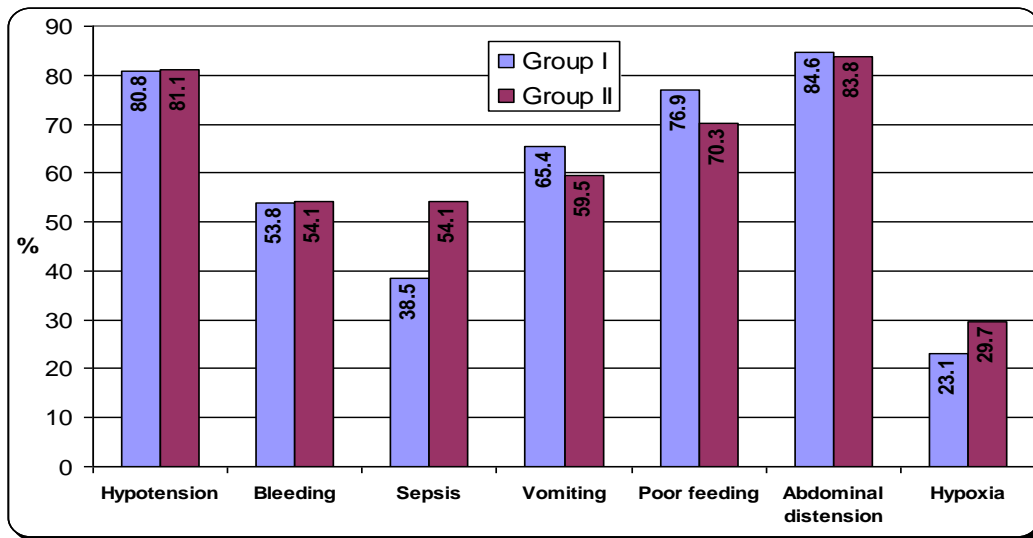
**Figure (1): presenting manifestations.**

Table (2): Outcome and length of stay among the included patients:

	Group A (n= 26)		Group B (n= 37)		P-value
	No.	%	No.	%	
Hospital stay:(days)					<0.000
Mean \pm SD	35.35 \pm 9.83		50.14 \pm 13.98		
Median (Range)	34.0 (23.0 – 58.0)		42.0 (38.0 – 74.0)		
Operation:					0.031
Operated	14	53.8%	10	27.0%	
Non-operated	12	46.2%	27	73.0%	
Outcome:					0.891
Died	6	23.1%	8	21.6%	
Improved	20	76.9%	29	78.4%	

The length of hospital stay were more among died neonates in both groups, the group (A) ($p=0.024$) and the group (B) ($p=0.04$) (Table 3).

Table (3): Length of stay according to the outcome:

	Length of stay (days)	Outcome		P-value
		Died	Improved	
Group A	Mean \pm SD	41.83 \pm 6.01	33.40 \pm 10.02	0.024*
	Median (Range)	43.0 (35.0-50.0)	30.5 (23.0-58.0)	
Group B	Mean \pm SD	66.63 \pm 2.45	45.59 \pm 12.28	0.004*
	Median (Range)	66.0 (63.0-70.0)	40.0 (38.0-74.0)	

As regard to correlation of mortality with the surgical intervention, in the group (A) there was no significant correlation ($p=0.170$), in the other hand there was significant correlation between mortality and surgical intervention in the group (B) ($p=0.021$) (Table 4).

Table (4): The outcome according to surgical intervention:

	Surgical operation	The Outcome				P-value
		Died		Improved		
		No.	%	No.	%	
Group A	Operated	5	83.3	9	45.0	0.170
	Non-operated	1	16.7	11	55.0	
Group B	Operated	5	62.5	5	17.2	0.021*
	Non-operated	3	37.5	24	82.8	

There was significant correlation between length of stay and death ($p=0.001$), also there was significant correlation between sepsis and death ($p < 0.001$) and significant correlation between hypoxia and death ($p=0.001$). (Table 5).

Table (5): The outcome according to length of stay and presenting manifestations.

	The Outcome		P-value
	Died	Improved	
	Mean ± SD	Mean ± SD	
Gestational age: (weeks)			
Mean ± SD	33.07 ± 2.56	33.45 ± 2.54	0.706
Median (Range)	33.0 – 38.0	33.0 – 40.0	
Length of stay: (days)			
Mean ± SD	56.00 ± 13.39	40.61 ± 12.82	0.001*
Median (Range)	64.0 – 70.0	39.0 – 74.0	
Sepsis: No. (%)			
Yes	14 (100.0%)	16 (32.7%)	0.000*
No	0 (0.0%)	33 (67.3%)	
Abdominal distension: No. (%)			
Yes	14 (100.0%)	39 (79.6%)	0.100
No	0 (0.0%)	10 (20.4%)	
Hypoxia: No. (%)			
Yes	9 (64.3%)	8 (16.3%)	0.001*
No	5 (35.7%)	41 (83.7%)	

DISCUSSION

The present study was the first population study in Egypt to compare outcomes in management surgically risk necrotizing enterocolitis (Modified Bell's Staging, stage IIB & Stage IIIA) between tertiary center with surgical facilities and those without.

One of the goals of this study was evaluation of the possible effects of transport of patients for center with surgical facilities on prognosis of surgically risk necrotizing enterocolitis. There are different level neonatal care consists of basic care (level I), specialty care (level II), and subspecialty intensive care (level III, level IV), that levels depend mainly on complexity of care they provide and surgical care, level IV can provide on-site surgical repair of serious congenital or acquired malformations^[20,21].

In our locality, most of surgically risk NEC was transferred to the only tertiary center (level IV) even without surgical indication to transfer which lead to increase the burden on the tertiary center. In the other hand the experience of pediatricians in follow up of surgically risk NEC in neonatal care centers outside the tertiary center is deficient

In this study the overall patients were similar in both group including important factors that affect mortality, such as gestational age and birth

weight, which were matched in the neonates in the two groups

As regard to length of stay; neonates in the group (B) had been more hospital stay ($p < 0.001$) because centers of this group had specific practices to prolong length of stay for neonates even after improvement, at the end of that study this practices was changed and discharge once improvement occur.

More surgical intervention was needed in the group (A) ($p = 0.003$), This can be clarified by our center is the only referral center for surgery in neonates in our locality. There were nearly similar outcome as regard to the mortality in both groups which was matched with study published by Kastenberget al.⁽²²⁾.

The length of hospital stay were more among died neonates in both groups, the group A ($p = 0.024$) and the group B ($p = 0.04$), which were similar to other studies^(18,19).

In the present study there was significant correlation between mortality and surgical intervention in the group (B) ($p = 0.021$). That may reflect greater severity of NEC in those neonates as most of them had sepsis which was considered main causes of death, better survival was seen among neonates with NEC in the group (A). These findings were in agreement with the retrospective cohort study by Kastenberget al., and B.S. Fullerton et al.^(22 & 17).

The present study recognize the main factors known to cause the overall mortality in neonates, Sepsis was the main cause of mortality ($p < 0.001$), also hypoxia was a important factor in increase mortality ($p = 0.001$), this was in agreement with many studies⁽²³⁻²⁵⁾.

Fourteen (38%) of the 37 neonates in the group (B) were transferred to surgical center. Not all transferred neonates had surgery.

There was some cases transfer from other centers with no qualified trained neonatologists in attendance full time to one of three centers who deal with the group (B). At the beginning of our study any neonate was proved to be Modified Bell's stage IIIA was transferred to Qena university hospital and in the wake of expanding the experience of pediatricians who manage neonates, the transfer was done after documentation of gastrointestinal perforation and so the rate of transfer to Qena university hospital was diminished.

This study recognize that neonates with surgically risk NEC need a good neonatal intensive care units but not essentially tertiary center with surgical facilities

Our study had important implications for public health policy in our locality as it decrease the burden on our tertiary center which in past was admitting all neonates with surgically risk NEC and these lead to increase places available for other dangerous disease in neonates, and furthermore increment the experience of pediatricians in our area as regard dealing with surgically risk NEC especially that one of this center was Qena General Hospital which is the largest hospital in our locality.

On the other hand, this study helps us to put guidelines for the standard care of neonates transported between hospitals, as regard to good preparation, availability of transport equipment and clinical protocols.

This study may evocate us for other long term studies with more details as regard disease burden resulting from hospital transfer, also stricture and neurodevelopment affection of patients.

Also future researches must answer many questions as regard importance of the time of diagnosis of surgical NEC, the time of transfer and the time of surgery in prognosis of disease.

CONCLUSION

There is no significant difference as regard to mortality of neonates with surgical risk NEC managed in centers with surgical facilities compared with similar neonates in centers with no surgical facilities, also more cooperation between pediatric surgeons and pediatrician in our locality have positive implication in the introduction of good care for neonates with NEC.

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