Use of oral gut decontamination in a level 3 neonatal surgical intensive care unit

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Background

Neonates with surgical gastrointestinal conditions on prolonged parenteral nutrition (PN) are at higher risk of blood stream infections caused by enteric bacteria, which is thought to be due to bacterial translocation. GI dysmotility and resulting dysbiosis leads to long term PN requirements and difficulty tolerating full enteral feed volumes.

Gut decontamination is using non-absorbable oral antibiotics to prophylactically try and prevent endogenous infections and modify the gastrointestinal microbiota.

Our unit commences oral gut decontamination (OGD) for selective neonates at high risk of bacterial translocation. Each antibiotic is used for 2 weeks then cycled to prevent resistance developing. We use gentamicin, then vancomycin and metronidazole then tobramycin before cycling back to gentamicin. To our knowledge our unit is unique in the use of OGD to minimise risk of sepsis and poor growth. This study aimed to describe unit practice and review outcomes.

Methods

Retrospective data was collected from single tertiary surgical neonatal unit. Patients who had received OGD (Table 1) over a 2-year period were identified using BadgerNet. Patient records, drug charts and electronic results system were reviewed.

After testing for normality, z-scores for weight and feed volumes before and after treatment were compared using paired t-test and Wilcoxon matched pairs test respectively. Sepsis rates before and after treatment were analysed using a two-tailed chi-squared test. P-values of <0.05 were considered significant.

Table 1. Cycling gut decontamination

1	Gentamicin	2.5mg/kg orally three times a day for 2 weeks
2	Vancomycin	5mg/kg orally four times a day for 2 weeks
AND	Metronidazole	7.5mg/kg orally three times a day for 2 weeks
3	Tobramycin	20mg orally four times a day for 2 weeks
Then cycle back to oral gentamicin		

Results

Over the 2-year period 13 patients received oral gut decontamination

Table 2. Patient characteristics

	All patients (n=13)
Gestational age, median (range)	31+2 (23+0, 36+4)
Birthweight, g, median, (range)	1765 (460, 2890)
Male, n (%)	6 (46)
Diagnosis	
NEC and perforation, n (%)	6 (46)
Gastroschisis, n (%)	4 (31)
Spontaneous intestinal perforation, n (%)	1 (8)
Other, n (%)	2 (15)
Ileo-caecal valve present, n (%)*	8 (67)
Stoma, n (%)	11 (85)
Age at starting OGD, days median, (range)	72.0 (31, 132)
Duration of decontamination, days median, (range)	41 (8,147)

All patients had a surgical diagnosis. Two patient died, this was not due to sepsis and they were not on OGD at the time of death.
Indications for starting OGD included previous septic episodes, inability to increase enteral feeds due to high stoma output, and poor weight gain.

Sepsis:
Before treatment there were 16 episodes of sepsis; 25% of episodes were gram-negative organisms, 50% gram-positive and 25% mixed. After treatment there were 14 episodes of sepsis of which 14.2% were gram-negative, 64.3% gram-positive and 21.4% mixed. (Table 3)

Table 3. Organisms isolated in blood cultures before and after gut decontamination

	Before gut decontamination		After gut decontamination	
Organism	Number of BSIs with positive blood cultures n= 16 *(% of total BSI)*	Number of children (n=10) with BSI due to microorganism *(% of children)*	Number of BSIs with positive blood cultures n= 14 *(%of total BSI)*	Number of children (n=10) with BSIs due to microorganism *(% of children)*
Gram positive				
Coagulase-negative Staph.	4 (25)	3 (30)	6 (42.9)	6 (60)
Enterococcus faecalis	3 (18.7)	3 (30)	3 (21.4)	2 (20)
Bacillus cereus	1 (6.3)	1 (10)		
Gram negative				
E. Coli	1 (6.3)	1 (10)		
Klebsiella sp.	1 (6.3)	1 (10)	1 (7.1)	1 (10)
Enterobacter sp.	1 (6.3)	1 (10)	1 (7.1)	1 (10)
Serratia marcescens	1 (6.3)	1 (10)		
Mixed infections	4 (25)	3 (30)	3 (21.4)	3 (30)

Growth and feeding:
The mean PN volume was lower following OGD (70mls/kg/day vs. 102mls; p=0.07). Prior to treatment 23% of patients were exclusively on maternal breast milk. Mean enteral feed volume increased after OGD (44mls/kg/day vs. 56mls/kg/day p=0.57). There was marginal increase in weight z-scores after OGD (-1.56 vs. -1.51, p=0.83). (Table 4)

Table 4. Weight and feeding (mean) before and after OGD

Before gut decontamination		After gut decontamination		p-value
Weight z-score	-1.56	Weight z-score	-1.51	0.83
PN volume (ml/kg/day)	102	PN volume (ml/kg/day)	70	0.07
Enteral feed volume (ml/kg/day)	44	Enteral feed volume (ml/kg/day)	56	0.57

Conclusions

Use of OGD in neonates has very limited evidence base and is mainly used in surgical babies. The protocol on our unit is extrapolated from adult studies.

It is promising that in our study we saw a decrease in the proportion of gram-negative sepsis after initiation of OGD. Gram negative organisms are seen in sepsis secondary to bacterial translocation. The antibiotics used in our OGD regimen predominantly target gram-negative organisms.

As a secondary outcome we also observed an increase in weight, and enteral feed volumes after initiation of OGD for most babies, although neither change reached statistical significance. There are too many confounding factors, most importantly time, to attribute these observed changes to OGD.

The volumes of OGD used are small and well tolerated. There is no evidence of systemic absorption, and we did not have any concerns regarding toxicity.

This study adds to the limited literature regarding use of OGD in neonates. Findings of this study were limited by small sample size and heterogenous population.
OGD is an infrequently used treatment which may have a role in reducing sepsis secondary to bacterial translocation in this unique population. Further multicentre trials are needed to evaluate the impact of this practice.

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