Original Article

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Total bilirubin in nasogastric aspirates: A potential new indicator of postoperative gastrointestinal recovery

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ABSTRACT

Background: The aim of our study was to investigate if total bilirubin (T-bil), amylase (Amy), and sodium (Na) in nasogastric (NG) aspirates can reflect gastrointestinal motility reliably. **Materials and Methods:** NG aspirates from all laparotomies lasting more than 150 min in children less than 12 months old were studied for 3 months. Color of aspirates and intensity of bowel sounds were graded every 3 h by nursing staff and aspirate samples for measuring T-bil, Amy, and Na were collected independently every 12 h until an oral fluid challenge was tolerated. **Results:** There were 26 subjects. Mean age at surgery was 5.6 months; mean body weight at surgery was 5.8 kg. No postoperative complications occurred. While there was no reduction in average volume of NG aspirates, color change was subjective, and bowel sounds could not be standardized, T-bil decreased over time (0d: 4.4 mg/dL; 0.5d: 2.7 mg/dL; 1.0d: 1.6 mg/dL; 1.5d: 1.3 mg/dL; 2.0d: 0.4 mg/dL; 2.5d: 0.33 mg/dL; 3.0d: 0.21 mg/dL; 3.5d: 0.15 mg/dL; 4.0d: 0.06 mg/dL; 4.5d: 0.05 mg/dL; 5.0d: 0.02 mg/dL; 5.5d: 0.02 mg/dL; 6.0d: 0.01 mg/dL). Amy and Na were inconclusive. **Conclusion:** T-bil levels in NG aspirates may be useful as a reliable objective quantitative marker of gastrointestinal motility postoperatively.

Key words: Amylase, nasogastric aspirates, sodium, total bilirubin

INTRODUCTION

It is well-established that the motility of the gastrointestinal tract is temporarily impaired after surgery. The effect that an abdominal operation has on gastrointestinal motility is generally referred to as "postoperative ileus," a term denoting disruption of the normal coordinated movements of the gut, resulting in failure of the propulsion of intestinal contents.[1] Nasogastric (NG) decompression following laparotomy, as a prophylactic measure to prevent nausea, vomiting, and abdominal distention, to decrease postoperative ileus, and to protect enteric anastomoses, is routine in most centers.[2] Early postoperative oral feeding has also been suggested to be beneficial for diminishing the duration of postoperative ileus.[3]

Postoperative recovery of gastrointestinal motility is traditionally monitored by assessing NG aspirates (volume, color), intensity of bowel sounds, passage of flatus or motions, and radiologic findings. However, there are physical limitations, particularly in neonates and infants, and multiple imaging involves radiation exposure. The aim of our study was to investigate if NG aspirate biochemistry, in particular, total bilirubin (T-bil), amylase (Amy) and sodium (Na), can provide consistent objective results for assessing postoperative gastrointestinal recovery.

MATERIALS AND METHODS

We studied all cases of major laparotomy (operating time at least 150 min) in patients less than 12 months old at our pediatric surgery unit over a 3-month period. Any surgery lasting less than 150 min and surgery for intestinal stoma creation were excluded from this study. All subjects had NG tubes (5 or 8 Fr single lumen) inserted routinely, with aspiration every 3 h by nursing staff to evacuate gastric contents until a trial of oral fluid was tolerated. Duration of NG insertion and timing of first oral intake were determined by the attending surgeon, based on conventional signs of postoperative recovery (volume/color of NG aspirates, intensity of bowel sounds/passage of flatus). Aspirates were graded for color: 1 = colorless, 2 = light yellow, 3 = yellow, 4 = light green, 5 = green and bowel sounds were graded

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for intensity: 1 = loud/frequent, 2 = loud/infrequent, 3 = soft/frequent, 4 = soft/infrequent, 5 = absent. Aspirate samples were collected every 12 h by the first author (Go Miyano [MG]) independently of routine postoperative care to measure T-bil, Amy, and Na. Pearson correlation coefficients were calculated to test the correlation of each of the following factors (T-bil, Amy, Na, NG aspirates volume, color, intensity of bowel sounds, etc) with time. Statistical significance was set at $P < 0.01$.

RESULTS

There were 26 subjects. Mean age at surgery was 5.6 months; mean body weight at surgery was 5.8 kg. Surgery performed was intestinal anastomosis (9/26 or 35%) for congenital intestinal atresia in six, and one case each of internal hernia, incarcerated hernia, and necrotizing enterocolitis; stoma closure (7/26 or 27%) for Hirschsprung's disease in three, and two cases each of necrotizing enterocolitis and anorectal malformation; tumor resection (3/26 or 11%) for Wilms' tumor in two cases and neuroblastoma in one case; and one case each of surgery for biliary atresia, choledochal cyst, congenital diaphragmatic hernia, Nissen fundoplication, Ladd's procedure, Hutchinson's procedure, and pull-through for total colonic aganglionosis. There were no major postoperative complications.

In general, there was no consistent reduction in average volume of NG aspirates observed over time from 20.9 mL at postoperative day (POD-0) to 29.6 mL at POD-6 ($P = 0.3$) [Figure 1], but color lightened slowly from 3.1 at POD-0 to 2.4 at POD-6 ($P = 0.02$), and bowel sounds increased slowly from 3.9 at POD-0 to 2.8 at POD-6 ($P = 0.02$) [Figure 2]. Average T-bil in NG aspirates fell over time as bowel activity resumed (0d: 4.4 mg/dL; 0.5d: 2.7 mg/dL; 1.0d: 1.6 mg/dL; 1.5d: 1.3 mg/dL; 2.0d: 0.4 mg/dL; 2.5d: 0.33 mg/dL; 3.0d: 0.21 mg/dL; 3.5d: 0.15 mg/dL; 4.0d: 0.06 mg/dL; 4.5d: 0.05 mg/dL; 5.0d: 0.02 mg/dL; 5.5d: 0.02 mg/dL; 6.0d: 0.01 mg/dL) [Figure 3], which was statistically significant ($P = 0.001$), but Na and Amy levels were inconclusive; Na (from 94 mEq/L at POD-0 to 47 mEq/L at POD-6) ($P = 0.1$), and Amy was so variable it could not be recorded accurately.

According to nursing records, flatus was passed on average after 3.8 days and a motion passed on average after 2.1 days. Oral fluids were first tolerated on average after 4.8 days, while NG tube removal was possible after an average of 5.9 days.

DISCUSSION

Although the use of NG tubes remains widespread, studies have repeatedly shown that NG tubes can be associated with potential complications of the respiratory, nasopharyngeal, and gastrointestinal tracts, as well as generalized subjective patient discomfort.[4] There have even been prospective studies comparing outcome following laparotomy with respect to NG tube insertion that showed little difference in morbidity and mortality rates but increased patient discomfort associated with the NG tube itself.[5] Thus, early NG tube removal and early postoperative feeding would allow the patient to recover as effectively as possible, provided the timing of NG removal can be quantified reliably.

Passage of flatus is generally used to indicate recovery of postoperative gastrointestinal recovery in adults, but it is difficult to assess in children and next to impossible in infants. In fact from our study, the first bowel movement was usually noted before the first passage of flatus, color of NG aspirates was too subjective, and grading of bowel sounds could not be standardized.

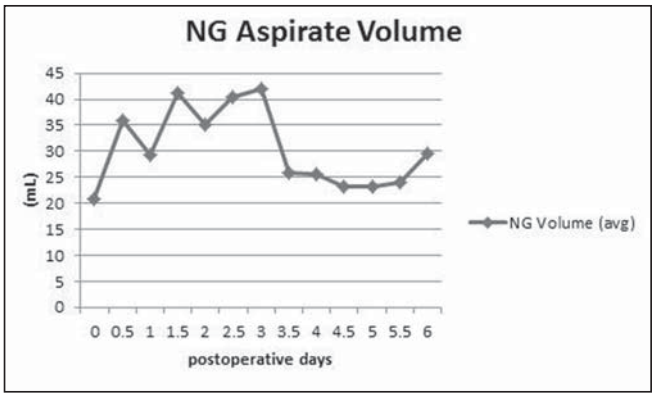


Figure 1: Postoperative change in average volume of NG aspirates. There was no consistent reduction in average volume of NG aspirates over time

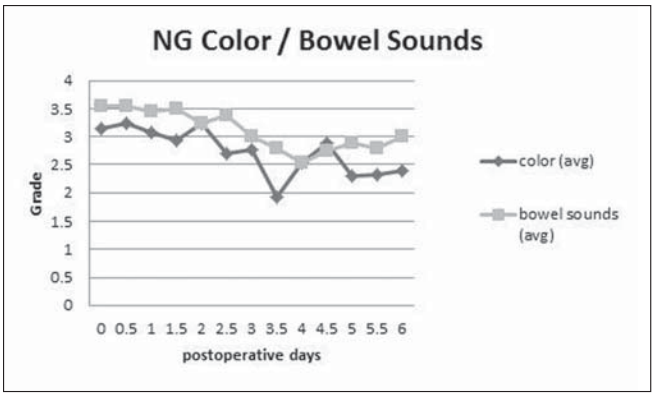


Figure 2: Postoperative change in color of NG aspirates and intensity of bowel sounds. The color of NG contents lightened slowly and bowel sounds increased slowly

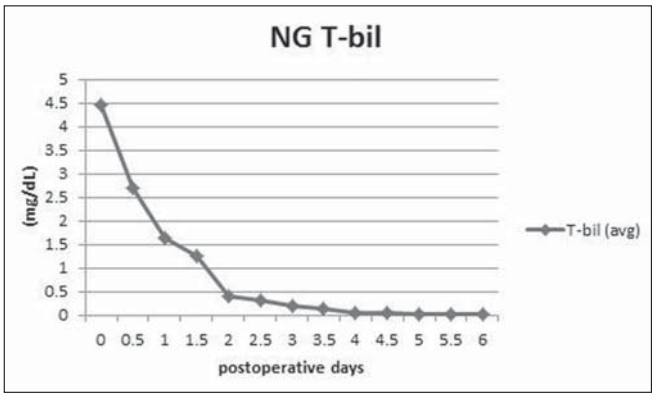


Figure 3: Postoperative change in T-bil in NG aspirates. Average T-bil in postoperative NG aspirates fell consistently over time

There was general resistance to using radiology because of radiation exposure.

Bilirubin, the most common pigment in bile, is not typically present in gastric fluid, but may be present if there is reflux from the duodenum to the stomach. Although there is a good correlation between total bilirubin and concentrations of pancreatic enzymes in cases of duodenoesophageal reflux,[6] we were not able to demonstrate any reliable changes in Amy or Na and suggest that T-bil alone may be the best indicator of postoperative intestinal recovery according to NG aspirate content.

Our study indicates that T-bil levels in NG aspirates would appear to be a reliable marker of the recovery of gastrointestinal motility postoperatively. We plan to expand our study of NG aspirates to assess if NG T-bil levels could correlate with severity in cases of bowel obstruction, thus providing the surgeon with a simple quantitative marker of compromised bowel motility that could be used to scale severity objectively, especially in younger smaller patients.

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