

MERCURY-IN-GLASS THERMOMETER AS A CAUSE OF NEONATAL RECTAL PERFORATIONS: A REPORT OF THREE CASES AND REVIEW OF THE LITERATURE

AUTHORS:

Ayeed Al-Qahtani MD, Abdulkarim El-Wassabi MD
Abdulrahman Al-Bassam FRCS(Ed)
King Khalid University Hospital
Pediatric Surgery Division
Department of Surgery Division
Riyadh, Kingdom of Saudi Arabia

Running Title: Rectal perforations induced by thermometer

ABSTRACT:

This report describes three cases of rectal perforation consequent to the insertion of mercury-in-glass rectal thermometer. Within hours following rectal perforation the neonates became listless with refusal to accept feeds. Abdominal distention and tenderness were detected on clinical examination. Emergency laparotomy was performed in all the patients. The rectal perforation was closed and the loop sigmoid colostomy created. Colostomy was closed after 4-6 weeks, recovery was uneventful in two cases whereas one developed stenosis of colostomy closure site. The use of mercury-in-glass rectal thermometer in neonates is a cause of rectal perforation. It is therefore recommended that either axillary thermometer or flexible rectal probe be used in neonates instead of mercury-in-glass rectal thermometer for determination of body temperature.

Keywords: Rectal perforation, Mercury-in-glass-thermometer, newborn.

INTRODUCTION:

Gastrointestinal perforation in neonates continues to be a challenging problem in pediatric surgical practice because of the high mortality due to resulting peritonitis and sepsis^(1,2). Rectal probing in the neonates carries a risk of perforation. Mercury-in-glass rectal thermometer as a cause of rectal perforation, to date only 29 cases have been reported. Although a rare condition, the high rate of mortality associated with rectal perforation emphasizes the need for the medical staff to be aware of the serious and life threatening complications of a simple procedure for assessment of body temperature. This report describes three more cases of rectal thermometer induced perforations and a review of the literature.

CASE 1:

A full term healthy baby girl weighing 3.5 Kg. Delivered by caesarian section was admitted to the newborn nursery at King Khalid University Hospital Riyadh, where routine rectal temperature was recorded using a mercury-in-glass thermometer. Twenty hours after birth she was found lethargic, listless and refused to accept feeds. On examination, abdomen was distended with guarding and tenderness. Gross pneumoperitoneum was detected on plain x-ray abdomen (Fig.1). Emergency laparotomy was performed which revealed a small perforation in the anterior wall of the rectum just above the peritoneal reflection with gross meconium spillage. Rest of the bowel was normal. Perforation was closed and loop sigmoid colostomy was created. The infant remained well during the follow up and colostomy was closed after 6 weeks.

CASE 2:

A full term healthy male infant weighing 2.8 Kg. was delivered by normal vaginal delivery and admitted to a newborn nursery in a private hospital. Routine rectal temperature was recorded using mercury-in-glass thermometer. On the second day of delivery, he became lethargic and refused to accept feeds. Abdominal distension, guarding and tenderness were noticed on examination. Gross pneumoperitoneum was evident on plain x-ray abdomen. Emergency laparotomy revealed a small perforation in the anterior wall of the rectum 1 cm above the peritoneal reflection with meconium spillage. Small and the large bowel were normal. Perforation was closed and loop sigmoid colostomy was performed. The infant remained well after the surgery and colostomy was closed after four weeks. Three months after the closure of colostomy the patient presented with abdominal distension and constipation. Barium enema

confirmed a stenotic area at the site of colostomy closure. The stenotic area was resected and reanastomosis done. The patient made an uneventful recovery.

CASE 3:

A full term healthy male infant weighing 3 Kg. Delivered by normal vaginal delivery was admitted to the newborn nursery of the same private hospital where Case 2 was admitted. Routine rectal temperature was recorded using mercury-in-glass thermometer. On the following day 12 hours after the Case 2 was diagnosed, this infant became lethargic, refused to accept feeds and started vomiting. Abdominal distension, guarding, tenderness and rigidity were present on examination. Emergency laparotomy was performed after detection of gross pneumoperitoneum on plain x-ray of abdomen. A small perforation was present in the anterior wall of the rectum just above peritoneal reflection with meconium spillage. Perforation was closed and a loop sigmoid colostomy was performed. Colostomy was closed after six weeks and the patient remained well in the follow up.

DISCUSSION:

Despite advances in neonatal intensive care, antibiotic therapy, parenteral nutrition and operative and anesthetic techniques, neonates continue to have high mortality after gastrointestinal perforation^(1,2). According to the nature of causative agent, the neonatal gastrointestinal perforation has been classified into two groups. First group comprised of neonatal gastrointestinal perforations occurring spontaneously without any underlying disease process. The second group consists of gastrointestinal perforations caused by underlying disease process and are called secondary perforations. The commonest cause of secondary gastrointestinal perforation is necrotizing enterocolitis^(2,3,4). Other causes of secondary gastrointestinal perforation include meconium ileus, meconium disease of prematurity, Hirschsprung's disease, mid-gut volvulus, atresia, strangulated hernia, omphalocele, imperforated anus, complication of peptic ulcer disease, ruptured appendix, mesenteric thrombosis, pneumatosis cystoides intestinalis and traumatic causes^(2,5).

Traumatic perforation may involve the upper gastrointestinal tract as in nasogastric tube placement or lower gastrointestinal tract after certain procedures like enema, anal dilatation, rectal biopsy and rectal thermometer insertion. Rectal perforation secondary to thermometer insertion in newborn infants is a rare but serious accident⁽⁶⁾. This can be avoided if the anatomy of infant rectum is taken into consideration. Smiddy and Benson⁽⁶⁾ (1969) pointed out that the shape of the neonatal rectum causes a thermometer to impinge on the anterior wall when it is inserted to a depth of 2 cm and any attempt to push it further may result in perforation. In 1970, Merenstein⁽⁷⁾ stated that the thermometer needs to be inserted to at least 5 cm to get an adequate core temperature. These arguments would seem to be superfluous as

closed axillary temperature was shown to correlate well with the rectal temperature. In addition, it was shown that if there should be any difference it would be no more than $0.2^{\circ}\text{C}^{(8)}$. It is therefore recommended that the only way to eradicate this potentially fatal condition is to stop the dangerous use of the rectal thermometer in the neonates. All the cases described in this study had perforation in the anterior rectal wall. Since no other rectal instrumentation was performed except the insertion of rectal thermometer it is highly likely that the rectal perforations were caused by the thermometer insertion.

Rectal perforation following insertion of rectal thermometer has been rarely reported in the literature. The first case of rectal perforation caused by thermometer was reported by Segnitz⁽⁹⁾ in 1957. In 1974, over a period of three months nine infants developed a serious illness in a private hospital. The illness which developed one to three days after birth was characterized by abdominal distension, peritonitis and pneumoperitoneum. Clinical, laboratory and epidemiological evidence strongly suggested that the illness was the result of rectal perforation caused by thermometers⁽¹⁰⁾.

Until 1976 total number of reported cases was 24 with an overall mortality of 38%⁽¹⁰⁾. The number of such reports decreased considerably from then onwards. Including the neonates described in the present study only eight cases of rectal perforation have been reported between the years 1976 and 1999 with no mortality^(2,5,11) (Table 1).

Rectal perforation cause by thermometer has virtually been eliminated in Europe and North America by avoiding the use of rectal thermometer and using axillary thermometers for monitoring newborn infants. This is also supported by the fact that there has been a sharp decline in the number of such reports over the last decade.

The practice of using rectal thermometer is still prevailing in many countries especially in the developing world. Such accidents may well be occurring and it is believed that they are being under reported. Case 2 and Case 3 came from the same hospital on the same day from the same newborn nursery. A particular nursing staff was responsible for rectal perforations in both the cases. This was clearly due to lack of nursing skill which emphasizes the need to have experienced medical staff looking after the newborns. Following these three accidents over a short period of time the use of rectal thermometers was officially banned in the concerned hospitals. Since then there has been no incident of thermometer induced rectal perforation in these hospitals. It is therefore recommended that such policies should also be adopted in other hospital.

It is important to avoid rectal perforation cause by thermometer by giving up the use of mercury-in-glass rectal thermometer in neonates. For assessment of body temperature axillary thermometer should be used as a routine. Flexible rectal probes should be used if rectal temperature assessment is mandatory. In case of an accident early diagnosis and prompt treatment are essential for the favorable outcome.

TABLE 1

**REPORTED CASES OF NEONATAL RECTAL PERFORATION
INDUCED BY THERMOMETER**

AUTHORS	DATE OF REPORT	NO. OF PATIENTS	NO. OF DEATHS
Horwitz and Bennet	1976*	24	10
Frank and Brown	1978	3	0
Lynch et al	1983	1	0
Tan et al	1989	1	0
Al-Qahtani, et al	present study	3	0
	TOTAL	32	10 (31%)

*Own cases and review of the literature to date (1976).

LEGENDS:

Figure 1: Plain upright posteroanterior abdominal x-ray showing massive pneumoperitoneum in case #1.

REFERENCES:

1. Greenbaum EI, Carson M, Kincannon WN, and O'Loughlin BJ: Rectal thermometer-induced pneumoperitoneum in the newborn. *Pediatrics*, 1969;44:539-542.
2. Tan CEL, Kiely EM, Agrawal M, Brereton RJ, and Pitz L: Neonatal gastrointestinal perforation. *J Pediatr Surg*, 1989;24:888-892.
3. Grosfeld JL, Molinari F, Chaet M, et al: Gastrointestinal perforation and peritonitis in infants and children: Experience with 179 cases over ten years. *Surgery*, 1996;120:650-656.
4. Campbell JR. Other conditions of the stomach, In: Welch KJ, Randolph JG, Ravitch MM, O'Neil JA, Rowel MI, ed 4 *Pediatric Surgery* Chicago IL, Yearbook, 1986:824-826.
5. Frank JD, Brown S: Thermometers and rectal perforations in the neonate. *Arch Dis Child*, 1978;53:824.
6. Smiddy, FG, Benson EA: Rectal perforation by thermometer. *Lancet*, 1969;2:805-806.
7. Merenstein, GB: Letter: Rectal perforation by thermometer. *Lancet*, 1970;1:1007.
8. Mayfield SR, Bhatia J, Nakamura KT, Rios GR, and Bell EF: Temperature measurement in term and preterm neonates. *J Paediatr*, 1984; 104:271-275.
9. Segnitz RH: Accidental transanal perforation of the rectum. *Am J Dis Child*, 1957;93:255-258.
10. Horwitz MA, Bennet JV. Nursery outbreak of peritonitis with pneumoperitoneum probably caused by thermometer-induced rectal perforation. *Am J Epidemiol* 1976;104:632-644.

11. Lynch DF, Peterson NR, Powel RW: Pseudotorsion of testis. Urology 1983;21:68-69.