Primary Fascial Closure in 112 Infants with Gastroschisis

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Primary fascial closure of gastroschisis remains controversial. Some surgeons routinely place a prosthetic silo over the exposed bowel, planning a staged closure. From August 1987 to August 2004, 129 cases of gastroschisis were treated at the Pediatric Surgical Unit, Department of Surgery, Ratchaburi Hospital. There were 61 boys and 68 girls. One hundred and seven mothers were primigravida. Associated anomalies were present in 13 patients. One hundred and twelve patients underwent primary fascial closure. The success of this technique depends on enlarging the abdominal cavity and decreasing the volume of the bowel that must be replaced in the peritoneal cavity. Thorough preoperative rectal irrigation should evacuate all meconium. Seventeen patients required staged prosthetic pouch with final closure. The duration of post-operative ileus and length of hospital stay were shorter in infants who underwent primary fascial closure. Death occurred in 15 patients with primary fascial closure (13.4%) and 6 patients with staged prosthetic closure (35.3%). The present study indicated that primary fascial closure should be the treatment of choice whenever possible.

Keywords: *Gastroschisis, Primary fascial closure, Staged prosthetic closure*

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Ballantyne in 1904, in the section of his book entitled "Malformations and Monstrosities of the Abdomen" used gastroschisis to designate all somatic abdominal defects with the exception of the physiologic hernia of the umbilical cord[1]. The 2 to 3 cm diameter abdominal wall defect of gastroschisis is immediately to the right of a normally placed umbilical cord (Fig. 1)[2]. Rare cases of left-sided gastroschisis have been reported[3-5]. The entire midgut is eviscerated and appears shortened with a variable degree of edema and venous congestion. Closure of the abdominal wall, often achieved only with widely mobilized skin flaps, was the sole treatment choice until the end of the 1960s. Inanition associated with prolonged ileus and occasionally respiratory insufficiency resulted in a mortality rate as high as 50%[6]. In 1969, Allen and Wrenn reported staged abdominal wall closure using silicone rubber sheeting in four infants with a gastroschisis[7]. Only 2 months later, Wilmore et al described the survival of infants with bowel anomalies using full intravenous nutritional support[8]. Staged closure with a prosthetic pouch has been widely used since 1969[9-15], but the survival of infants born with gastroschisis has depended heavily on total parenteral nutrition. Novotny reported primary closure of their abdominal wall defect at the time of initial operation in 56 of 69 childrens[16]. The author has preferred initial closure with fascia when possible[17,18] and has evolved an approach that facilitated such closure in 112 of 129 patients cared for during the past 17 years.

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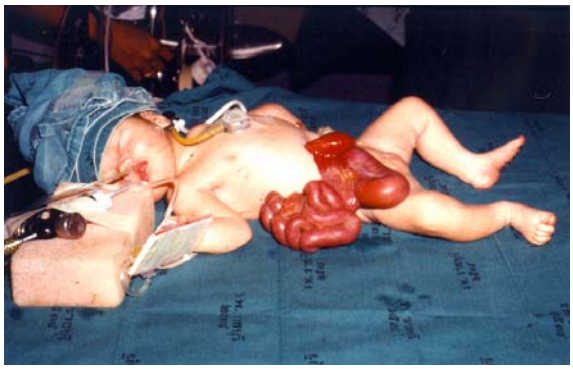

Fig. 1 Eviscerated bowel to the right side of the umbilical cord insertion

Material and Method

The charts and operative records of 129 patients with gastroschisis cared for at Ratchaburi Hospital from August 1987 through August 2004 were reviewed. Forty-five infants were the subject of an earlier report[17]. Maternal and neonatal parameters, details of operative technique, postoperative care and complications, feeding progress, length of hospital stay, and long-term follow-up have been tabulated.

Preoperative, Operative and Postoperative technique

All infants were resuscitated with intravenous fluid, nasogastric intubation, broad-spectrum antibiotics (Ampicillin 100mg/kg/day, Gentamycin 5mg/kg/day and Metronidazole 20mg/kg/day), rectal tube irrigation with warm saline solution to loosen and remove viscid meconium, kept warm in an incubator and transported to the operating room.

Under general anesthesia, the abdomen and intestines were washed with a solution of povidone-iodine. The umbilical cord was excised with the skin to allow the ligated urachus and umbilical vessels to retract. Enlargement of the skin defect by incising the upper and lower edge each about 2 cm was performed. The abdominal wall was slowly stretched with a kneading motion, beginning at the franks and progressing around the entire abdomen (Fig. 2). The intestinal contents were decompressed to the stomach and evacuated by nasogastic suction. The bowel and mesentery were inspected for atresia and volvulus. The eviscerated bowels were replaced into the peritoneal cavity (Fig. 3). Fascia and skin were closed with 3-0 silk sutures (Fig. 4). One hundred and twelve infants were closed by this technique. If the eviscerated bowels were not replaced into the peritoneal cavity or replaced with marked tension, a prosthetic pouch was constructed. The steri-drape sheet was sutured to full thickness of the abdominal wall defect (Fig. 5). The pouch is progressively tightened every day and fascial closure occurred 10 days later. A prosthetic pouch was used in 17 infants.

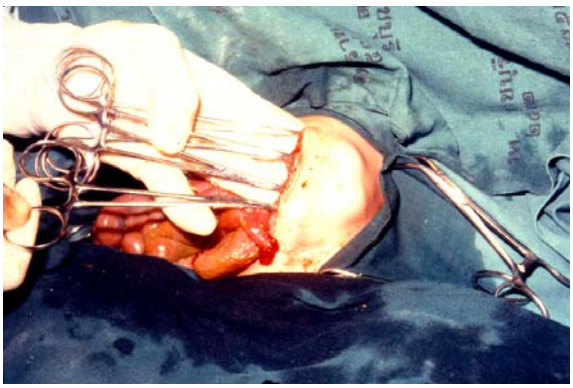

Fig. 2 The abdominal wall is slowly stretched with a kneading motion

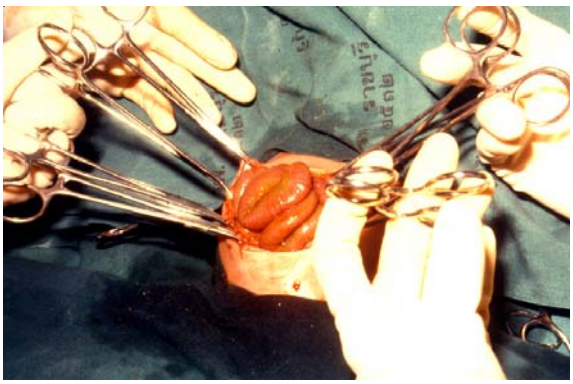

Fig. 3 The eviscerated bowels were replaced into the peritoneal cavity

Fig. 4 One patient after primary fascial closure was completed

Fig. 5 The steri-drape sheet is sutured to full thickness of the abdominal wall defect to form a pouch (silo)

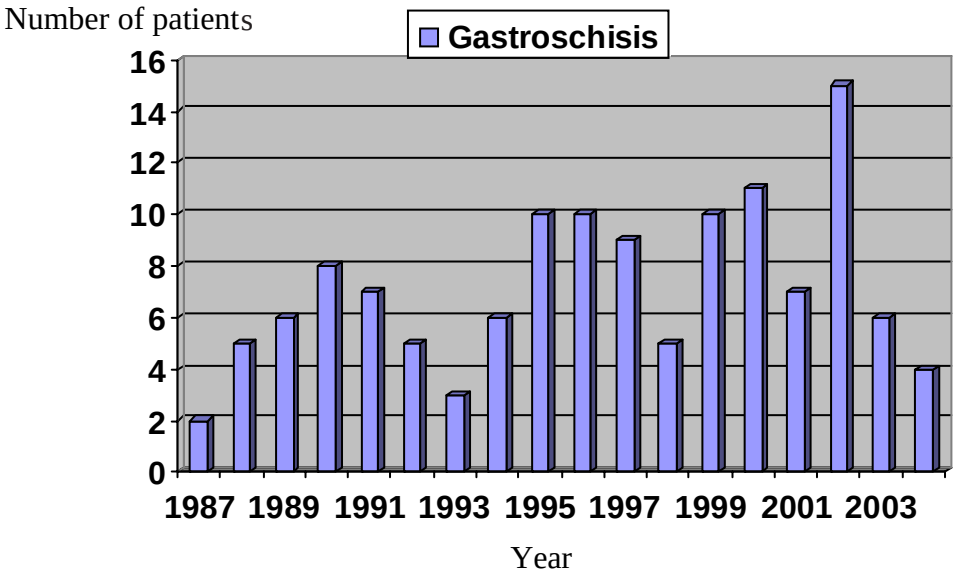

Fig. 6 Number of the patients each year during 1987-2004

Postoperatively all infants continued on mechanical ventilation for 2 days. Intravenous fluids were maintained and total parenteral nutrition was begun on the third day. Broad-spectrum antibiotics were given for 7 to 10 days. Abdominal wall sutures were stitched off and oral feeding was started on 14 days postoperation. Rectal stimulation with glycerine was administered if abdominal distention or slow feeding progress occurred.

Descriptive statistics: mean, range, bar diagram and histogram were presented for day of first postoperative feeding and length of hospital stay. To compare the different between the primary fascial closure and staged prosthetic closure were analysed by using non-parametric test. Probability values of < 0.05 were considered to be statistically significant.

Results

The present series included 61 boys and 68 girls. The number of patients in each year is shown in Fig. 6. The average birth weight was 2232 gm, and ranged from 1400 to 3200 gm. One hundred and seven mothers were primigravida. Twelve infants were delivered by cesarean section because of maternal indications. There was no family history of gastroschisis or other major anomalies.

Thirteen patients were noted to have associated congenital abnormalities. Most associated anomalies were related to nonrotation of the intestines and represented varying degrees of mesenteric ischemia (Table 1). There were 11 long-term survivors of these 13 infants: one had gangrenous midgut volvulus and died; two had jejuno-ileal atresia; two had colon atresia and one died; two had jejuno-ileal stenosis; two had ischemic jejuno-ileal perforations; one had total colonic aganglionosis; and two had left-sided gastroschisis.

No difference in the incidence of postoperative complications was noted between primary fascial closure and staged closure patients. Prolonged ileus occurred in twelve infants, necrotizing enterocolitis in two, pneumonia in three, and sepsis in four.

There were only two statistically significant differences between the two groups of patients. The

Table 1. Intestinal ischemia in 10 patients with gastroschisis

Lesion	No. survivors	Hospital stay (d)	Deaths
Gangrenous midgut volvulus	-		1
Jejuno-ileal atresia	3	110, 27,55	-
Colon atresia	1	22	1
Jejuno-ileal stenosis	2	70, 38	-
Ischemic jejunoileal perforations	2	69, 41	-

duration of ileus was estimated by noting the day of first feeding. The mean of 13.77 days (7 to 30 days) in those closed primarily contrasts with 22.36 days (14 to 32 days) in infants who underwent staged closure. When the postoperative period was grouped into 20-day intervals, the difference in first-day feeding was statistically significant ($p < 0.001$) (Fig. 7). Finally, primary fascial closure infants were discharged earlier, at 28.74 days (13 to 110 days), as contrasted with a mean of 51.91 days (25 to 84 days) for staged prosthetic closure patients. When length of stay was divided into 30-day periods, this difference was statistically significant ($p < 0.001$) (Fig. 8).

Mortality. There were 21 deaths, 15 with primary fascial closure (13.4%) and 6 with staged prosthetic closure (35.3%). Four of the 21 deaths were inevitable. One had severe anomalies; one, gangrenous midgut volvulus; and two, prematurity. Nine infants died of sepsis, probably related to central line infections. Three infants died of pneumonitis. Two infants died from aspiration. Three deaths were directly related to the operation.

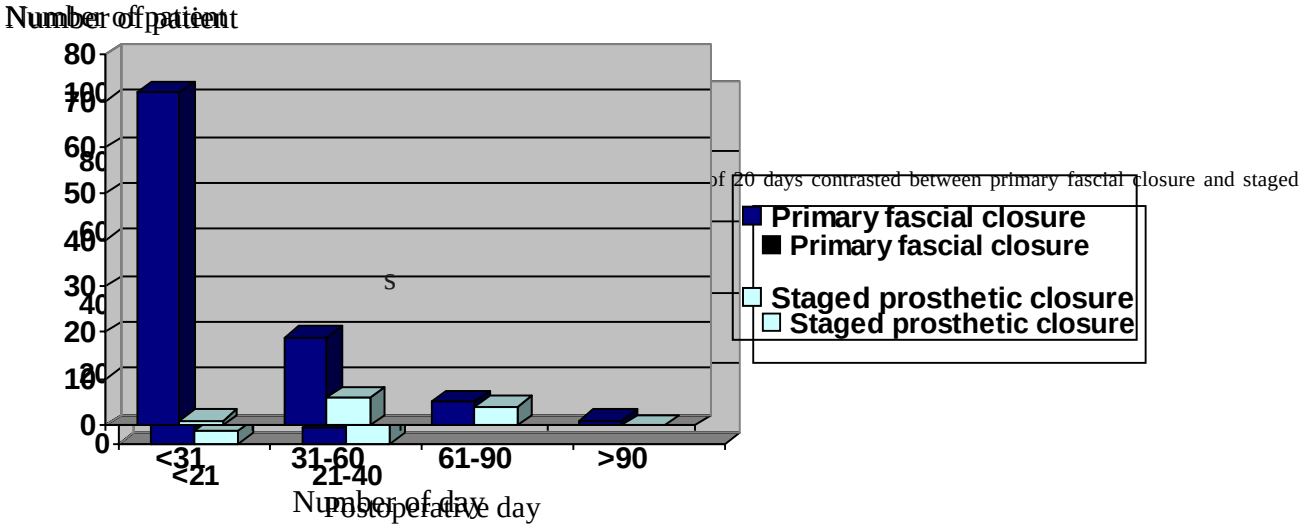

Fig. 8 Length of hospital stay divided into groups of 30 days contrasted between primary fascial closure and staged prosthetic closure infants

Prolonged gut dysfunction, and obstruction occurred in six infants, two of whom had atresia.

Discussion

Primary fascial closure has been the treatment of choice for gastroschisis in Ratchaburi Hospital during the past 17 years. Deliberate stretching of the abdominal wall, first described by Izant and Brown[19], and complete evacuation of intestinal meconium are essential to the success of this technique[6]. Mechanical ventilation has been routinely used in 2 days of postoperative care and the expected period of ileus is short. Seventy-two of 107 surviving primary fascial closure infants were discharged in < 31 days after an entirely uncomplicated course. One of 11 surviving staged prosthetic closure infants was discharged in < 31 days. Primary fascial closure was successful in 112 patients. When primary fascial closure was difficult, the author placed a steridrape pouch. The number of these patients is too small to show a difference in morbidity from primary fascial closure patients, but they clearly required longer hospitalization. In the author's experience, the staged prosthetic closure technique requires multiple operative procedures and may carry an increased rate of septic complications. The advantages of primary fascial closure are obvious: in shortening the ileus, eliminating the need for the second operation, and a reduction in the length of hospitalization. In conclusion, primary fascial closure should be the treatment of choice whenever possible.

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การเย็บปิดผนังหน้าท้องทุกชั้นแต่แรกในทารก Gastroschisis 112 ราย

สมชาย เทพเจริญนิรันดร์

การเย็บปิดผนังหน้าท้องทุกชั้นแต่แรกในผู้ป่วย Gastroschisis ยังคลุมเครือ ศัลยแพทย์บางท่านนิยมใช้วัสดุสังเคราะห์มาคลุมไว้ก่อนแล้วเย็บปิดภายหลัง ระหว่างเดือนสิงหาคม พ.ศ. 2530 ถึงเดือนสิงหาคม พ.ศ. 2547 มีผู้ป่วย Gastroschisis 129 ราย ได้รับการรักษาที่แผนกศัลยกรรมเด็ก กลุ่มงานศัลยกรรม โรงพยาบาลราชบุรี เป็นเด็กชาย 61 ราย เด็กหญิง 68 ราย มารดาครรภ์แรก 107 ราย พบความพิการอื่นร่วมด้วย 13 ราย มีผู้ป่วย 112 รายได้รับการเย็บปิดผนังหน้าท้องทุกชั้นแต่แรก ความสำเร็จของวิธีนี้ขึ้นอยู่กับการเพิ่มขนาดช่องท้อง และลดปริมาตรของลำไส้เพื่อนำลงสู่ช่องท้องรวมทั้งการสวนล้างลำไส้ก่อนการผ่าตัดเพื่อนำขี้เทาออกให้หมด ผู้ป่วย 17 รายได้รับการใช้วัสดุสังเคราะห์มาคลุมไว้ก่อนแล้วเย็บปิดภายหลัง ระยะเวลาการทำงานของลำไส้หลังผ่าตัด และจำนวนวันการรักษาในโรงพยาบาลของผู้ป่วยที่ได้รับการเย็บปิดผนังหน้าท้องทุกชั้นแต่แรกสั้นกว่า มีผู้ป่วย 15 ราย ที่ได้รับการเย็บปิดผนังหน้าท้องทุกชั้นแต่แรกเสียชีวิต (คิดเป็น 13.4%) และมีผู้ป่วย 6 รายที่ได้รับการใช้วัสดุสังเคราะห์มาคลุมไว้ก่อนแล้วเย็บปิดภายหลังเสียชีวิต (คิดเป็น 35.3%) การศึกษานี้แสดงว่าควรใช้การเย็บปิดผนังหน้าท้องทุกชั้นแต่แรกในการรักษาเมื่อเป็นไปได้