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The pivotal role of the surgeon in the results achieved in gastroschisis

Abstract A single neonatal surgical unit treated 42 cases of gastroschisis over a 12-year period (1981–1993). The surgical management of each case was individualised, but every attempt was made to perform a primary repair when possible, based on the premise that this strategy gave the best outcome. The eviscerated intestine was evaluated with the patient under general anaesthesia. Serosal peel was not removed and intestinal atresias were not repaired. Gangrenous intestine was resected. The contents of the bowel were emptied proximally via a large naso-gastric tube and distally via the anus with warm saline lavage. The anterior abdominal wall was stretched and then reduction of the prolapse attempted. Following maximal enlargement of the peritoneal cavity, it was left to the operator to decide whether primary repair was possible and, indeed, permissible in each instance. Staged repairs necessitated the use of silastic pouches. Respiratory and intestinal insufficiency were managed by intermittent positive-pressure ventilation and total parenteral nutrition (TPN). Over one-half of the cases (24 of 42) were under 2.5 kg at birth. Intra-uterine growth retardation was unusual. Ten babies were delivered for obstetrical indications by Caesarean section; 50% were pre-term and in 4 pre-natal diagnosis of a ventral abdominal wall anomaly had been made. The transmural defects were all sited at the umbilicus and were to the right of a consolidated cord in 41 instances. Midgut necrosis due to torsion was encountered in 1 case; 3 further cases with intestinal atresia occurred. Primary closure was obtained in 30 (71%) of the cases reviewed. A prosthetic pouch was used in 12 patients for on average 10 days in 10 uncomplicated cases. The average length of time in days of tertiary care given to 25 uncomplicated cases treated by primary fascial closure was: ventilatory support 4; intensive care treatment 8; and nutritional source TPN 20. There were 5 deaths (12%): 1 was unpreventable due to prenatal intestinal infarction; 2 were due to abdominal compartment syndrome with renal failure, and, intestinal ischaemia complicating primary and planned staged repairs; 1 caused by intestinal infarction due to torsion of bowel in a pouch; and 1 due to invasive infection. The role played by the strategy taken by the surgeon in the management of gastroschisis is crucial to the outcome. The creation of a compartment-like syndrome produced uncorrectable complications in this series of cases in both primary and staged abdominal wall closures. Minor degrees of this complication proved to be reversible in some patients, which was the reason for the wait-and-see attitude adopted in the management of this problem, often with fatal outcome. Where intra-peritoneal pressure monitoring is not used, the operating surgeon relies on unscientific observations for decision-making at the operating table. The time from birth to operation in 25 of the reviewed cases was on average 5½ h. Of this group, 20 were outborn babies. This is unsatisfactory, but as shown by this review, even in the absence of prenatal management, which should ensure prompt repair, satisfactory results are still possible.

Key words Gastroschisis • Individualised management • Compartment syndrome • Safe parenteral nutrition • Safe assisted ventilation

Introduction

In gastroschisis (GS) an uncovered evisceration of bowel occurs through an opening in the ventral aspect of the abdominal wall. The parietal defect, often in contrast to the opening in the skin, is nearly always sited at the umbilicus. This statement is made based on the observation that the fascial defect is an abnormal “umbilical ring” as it contains the umbilical vessels, clearly anatomically identifying this opening [12].
From a surgeon’s viewpoint, all the technical options used today in the operative management of GS were described well before 1970 (skin flap closure 1948; eviscerated mass bulk reduction 1963; stretching of the abdominal wall 1966; prosthesis 1967 [10, 19, 22, 24]. An evolution in their application, which probably was not universal, has been witnessed.

During the early 1970s, surgeons were proud to report their triumphs in the management of these up to then difficult cases.

When a prosthetic pouch is used, the sheeting is sutured to the full thickness of the abdominal fascia, muscle, and peritoneum (an ample base, large bites, non-absorbable material, and interrupted stitches). A skin-covered (buried) suture line is created and the skin is left open [24]. In the late 1970s surgeons found themselves at ease with this technique, although seemingly unavoidable complications still plagued its use.

Of major significance, the environment in which these cases were cared for changed during this period. It is true that the backbone of the successful treatment of these cases was and still is an ability to deliver complete parenteral nutrition (TPN) to the neonate. This development was surgeon-based, precipitated by the numerous intestinal anomalies in whose management parenteral nutrition revolutionised the outcome [8]. Similarly, the birth of neonatology by force of circumstance led to the development of safe, simple, and effective ventilatory support techniques. Within this new environment, the surgeon, up to then only a tailor, could now look further than the creation of a sac in the management of GS.

A review of recently managed cases confirms these statements and draws attention to the unanswered questions in regard to this congenital anomaly.

### Materials and methods

Forty-two consecutive patients with GS treated by a single neonatal surgical unit over the 12-year period 1981–1993 are reviewed (Table 1). In this group intra-uterine growth retardation was unusual, but over one-half (57%) of the infants were under 2.5 kg at birth (24 of 42). Ten infants were delivered for obstetrical indications by Caesarean section; 50% of this group were preterm, and in 4 prenatal demonstration of a ventral wall anomaly had been established. In 14 of the 42 cases gross ‘meconium’ staining of the liquor amni was documented.

No sac remnants or bands that could be of cord origin were found. The transmural abdominal wall defects were sited at the umbilicus. None stretched into the epigastric or hypogastric areas; 41 lay to the right of a consolidated cord. Hollow, but never solid, viscera were found in an extra-abdominal position. Varying degrees of intestinal damage (serosal peel; oedema; ischaemia) were always present. Damage was severe in 1 baby in whom midgut necrosis due to torsion had occurred; there were 3 further cases with intestinal atresias. The peel on the serosal surface of the intestines was commonly noted to be stained by bile pigment; this staining was severe in 10 instances.

Primary closure was performed in 30 of the 42 (71%) reviewed cases. A prosthetic pouch was used in 12 patients for an average 10 days in the 10 uncomplicated cases (6–17 days). The patients were weaned from ventilatory support using routine criteria. Parenteral feeding was started on the 2nd post-operative day. Special attention was given to assure that adequate continuous gastric decompression was maintained.

### Results

The average length of time in days of tertiary care given to 25 uncomplicated cases treated by primary fascial closure was: ventilatory support 4; intensive care 8; and TPN 20. There were 5 deaths (12%). A 1.5-kg baby born by Caesarean section at 29 weeks was not surgically treated as it had lost most of its intestinal tract due to prenatal infarction [13]. A 2.4-kg baby born vaginally at 38 weeks was managed by primary reduction and closure of the defect, but died from a nosocomial infection on the 10th post-operative day. A 1.6-kg baby born by normal vaginal delivery at 35 weeks and managed by primary reduction and closure failed to pass urine post-operatively. On day 2 the intestines were placed in a silo. At post-mortem examination multiple areas of infarction were found in the intestines and kidneys. A 2.6-kg baby born by normal vaginal delivery at 40 weeks was treated by staged closure. On day 2 post-operatively the silo was re-opened because of vascular collapse and persistant acidosis. Torsion of the mesentery had occurred with extensive intestinal gangrene. A 2.5-kg baby born by normal vaginal delivery at 40 weeks was treated by staged closure. The immediate post-operative period was complicated by renal failure. The silo was surgically revised on the 13th post-operative day. The patient died in renal failure complicated by jaundice and fungal sepsis on day 15.

### Discussion

The role played by the correct choice of strategy taken by the surgeon in the management of GS is crucial to the outcome [18, 32]. Overall, in the treatment of these cases this phase of management has become a proportionately minor one. The difficult part of the care of these patients lies in the hands of the intensivists.

Surgeons experienced in the treatment of these cases have simplified their tasks by developing a one-step approach to the problem in every case possible [3, 6, 9]. Injudicious primary closure of the abdomen with the creation of a compartment-like syndrome produced uncorrectable complications in this series of cases [7, 17, 38, 39]. Similar problems were also encountered with staged closure. Where intra-peritoneal pressure monitoring is not