Pediatr Surg Int (2000) 16: 536–537

TECHNICAL INNOVATION

Kari Vanamo

Silo reduction of giant omphalocele and gastroschisis utilizing continucous controlled pressure

Accepted: 26 April 1999

Abstract A method is described utilizing continuous controlled pressure to achieve smooth, rapid, and safe silo reduction of an anterior abdominal-wall defect. A metal tube with larger wheels at each end is suspended by runners and counterweights to slowly roll the silo and squeeze the contents into the abdominal cavity.

Key words Gastroschisis · Omphalocele · Abdominal wall defects · Silastic silo · Delayed primary closure

Introduction

In omphalocele (OMP) and gastroschisis (GS), primary repair with reduction of the viscera and closure of the abdominal wall defect is probably the surgical method of choice when it can be performed without undue elevation of the intra-abdominal pressure (IAP) [15]. When this is not possible, the available methods include topical treatment [7], skin closure with or without fascial closure with prosthetic material [8], muscular or myocutaneous flaps with or without tissue expansion [2, 12], staged reduction of the omphalocele sac [4, 6], external compression or adhesive tapes [10], and, most importantly, teflon or silastic chimneys (“silos”) to temporarily contain the eviscerated abdominal organs during staged reduction [1, 13].

Reduction of the silo is usually a staged procedure performed once or twice daily with a variety of means including sutures, clips, wooden tongue depressors, wringer clamps, and staplers [3, 5, 9, 11, 14]. The repeated manipulation of the silo during staged reduction may predispose it to detachment and cause steep fluctuations of IAP, leading to vascular compromise on the one hand and a delay in the process of reduction on the other. A method of creating continuous controlled pressure to achieve rapid but gentle reduction of the silo with subsequent delayed primary closure of the defect is described.

Materials and methods

In OMP the umbilical cord is trimmed, but the amnion is left otherwise intact. In GS the defect is enlarged when necessary to permit free entry of the intestines into the abdominal cavity. A customized silo to fit the defect is then made by sandwiching either tabular gauze or a silastic sheet between two layers of Opsite or similar adhesive material around a sterile bottle of suitable size. If the size of the defect permits, a soft infusion bag is used as a silo. The silo is then sutured to the skin margin with continuous polypropylene. The suture line is covered and enforced with a strip of Duoderm or Stomahesive.

Our reducing device (Fig. 1) is a metal tube with a larger wheel at each end. A suitable length of thread is rolled around each wheel. The upper end of the silo is fixed to the tube with a plate and screws and the device is hung from the ceiling of the incubator with runners and counterweights (Fig. 2). The weight of the device and the pull by the counterweights are transformed by the threads into a turning force that squeezes the silo and slowly rolls it around the tube as the contents are reduced into the abdominal cavity. The diameters of the tube and wheels and the counterweights are such that the pressure created by the squeezing action has never in an experimental setup exceeded 20 cm H_2O (Fig. 3). When reduction has been achieved the child is taken back into the operating room, the silo is detached, and the defect is closed with a single layer of horizontal mattress sutures.

Four neonates (two males, two females) have been treated with this method. One had an OMP, two had GS, and one had cloacal exstrophy and a large OMP. The reduction took from 3 to 7 days with counterweights between 430 and 600 g. Direct suturing of the abdominal defect was possible in three cases. In one case the fascia was repaired with a Gore-tex patch and the skin sutured over the patch. In the first case part of the omentum was trapped between the layers of the silo and was resected; in the remaining cases the reduction took place without problems. The mean duration of postoperative muscle relaxation was 8.5 (range 7–10) days and mechanical ventilation 17.8 (range 8–39) days. Feeding could be started on the 15th day on average (range 10–20 days) and the mean hospital stay was 45.8 (range 35–72) days.

Discussion

Standard techniques for manual reduction of a silo include suturing the silo or applying umbilical-tape ties [5, 14]. These procedures involve at least two people and can be time-consuming. The silo is rarely cylin-

K. Vanamo
Department of Pediatric Surgery,
Kuopio University Hospital,
FIN-70211 Kuopio, Finland

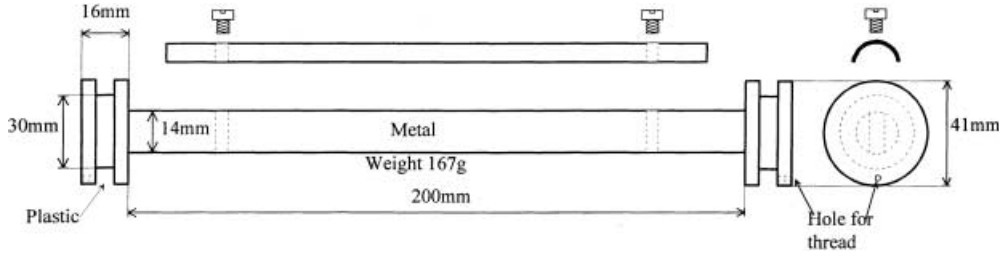

Fig. 1 Technical details of the reducing device: upper end of the silo is fixed to tube with aid of curved plate

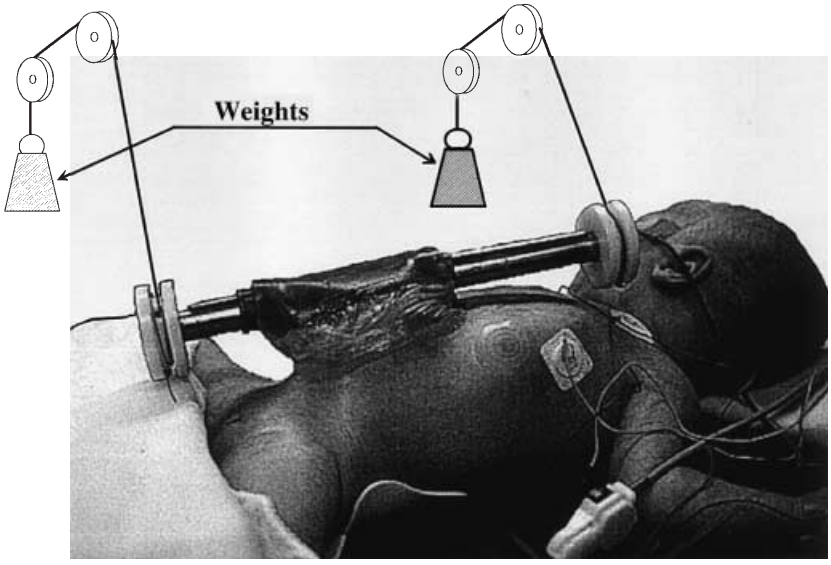

Fig. 2 Reduction in progress: weights can be adjusted to optimize rate of reduction

drical, and the application of tape ties tends to exert too great a pull on the ends of the long axis, which can result in premature separation of the silo at these points [9]. Plastic clips or tongue depressors also involve repeated manipulation of the silo and can lead to inappropriately high IAP [3, 9]. On the other hand, a fixed rate of adjustment may cause undue delay in the process of reduction. Various mechanical devices have been previously described, but have the disadvantage of being purpose-built, difficult to obtain, expensive, and need to be manually adjusted [11].

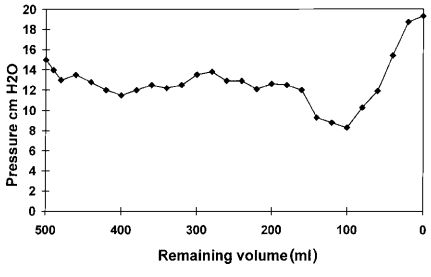

Fig. 3 Experimental setup: simulated intragastric pressure during reduction of silo. Pressure 3 cm below root of silo as a function of remaining volume of silo, traction 2 × 280 g

The method described here provides smooth and rapid reduction of the silo. The device can easily be made in any hospital workshop and is reusable. By controlling and limiting the pressure utilized in the process of reduction, it should also be safe, and we have not found it necessary to monitor the IAP, through a transparent silo one can easily observe the condition of the contents. Should incarceration take place, it is easy to unroll the device, reposition the contents, and continue the reduction. The device can be placed either transversely or longitudinally to obtain the most natural approximation of the edges of the defect. By adjusting the amount of counterweight, one can adjust the rate of reduction and the pull exerted by the device on the skin. With this method, delayed primary closure should be possible even in very large abdominal-wall defects.

References

1. Allen RG (1969) Silon as a sac in the treatment of omphaloceles and gastroschisis. J Pediatr Surg 4: 3–8
2. Cardenas-Ruiz- Velasco JJ, Gallardo-Meza AF, Piña-Garay MA (1992) Muscular flaps for closure of giant abdominal wall defects. Pediatr Surg Int 7: 401–403
3. Chittmittrapap S, Mondragon R, Tan KC (1992) Reduction and local care of the artificial sac in gastroschisis and large omphalocoele – a new technique. Pediatr Surg Int 7: 240–241
4. deLorimier AA, Adzick NS, Harrison MR (1991) Amnion inversion in the treatment of giant omphalocele. J Pediatr Surg 26: 804–807
5. Ein SH, Rubin SZ (1980) Gastroschisis. Primary closure of silon pouch. J Pediatr Surg 15: 297–300
6. Fufezan V (1992) A new concept and surgical technique for the treatment of large omphaloceles. Pediatr Surg Int 7: 157–159
7. Grob M (1957) Lehrbuch der Kinderchirurgie. Thieme, Stuttgart, pp 314–315
8. Gross RE (1948) A new method for surgical treatment of large omphaloceles. Surgery 24: 277–292
9. Huskisson LJ, Wright VM (1996) An easy method for adjusting a silo for delayed closure of gastroschisis. Pediatr Surg Int 11: 431
10. Lee SC, Jung SE, Kim WK (1997) Silo formation without suturing in gastroschisis: use of Steridrape for delayed repair. J Pediatr Surg 32: 66–68
11. Sawin R, Glick P, Schaller R, et al (1992) Gastroschisis wringer clamp: a safe, simplified method for delayed primary closure. J Pediatr Surg 27: 1346–1348
12. Schaeffer CS, King LR, Levin LS (1996) Use of the expanded thoracoepigastric myocutaneous flap in the closure of cloacal exstrophy. Plast Reconstr Surg 97: 1479–1484
13. Schuster SR (1967) A new method for staged repair of large omphaloceles. Surg Gynecol Obstet 125: 837
14. Schwarz MZ, Tyson KRT, Milliorn K, et al (1983) Staged reduction using a silastic sac is the treatment of choice for large congenital abdominal wall defects. J Pediatr Surg 18: 713–719
15. Swift RI, Singh MP, Ziderman DA, et al (1992) A new regime in the management of gastroschisis. J Pediatr Surg 27: 61–63