more common than the literature suggests, and emergency treatment with glucose or hydrocortisone, given by injection, should be given to any child with the disorder who suddenly or unexpectedly collapses.

We thank Drs. Barbara Donnison and E. de H. Lobo for their help.

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Addendum

Since the preparation of this report, Case 2 has developed recurrent convulsions which are not associated with hypoglycaemia and are almost certainly related to brain damage sustained at the time of her hypoglycaemic episode.

Gastroschisis treated with lyophilized dura

At the Royal Alexandra Hospital for Children, Sydney, it has usually been possible to manage babies with gastroschisis by reduction and primary suture after skin mobilization, muscle stretching, and transverse muscle division as recommended by Savage and Davey (1971). Our results with covering patches or pouches of silastic sheeting as described by Schuster (1967) have not been satisfactory. There has been unacceptable loss of peritoneal fluid at the edge of the silastic sac and necrosis of bowel has occurred under the silastic sheeting. We report 2 patients who demonstrate these complications and advantages of the use of lyophilized dura to replace the silastic sheeting.

Case reports

Case 1. A female weighing 1.6 kg at birth was admitted at 2 hours of age with a typical gastroschisis. There was an abdominal wall defect to the

right of the umbilicus through which prolapsed the small and large bowel, stomach, and a small amount of spleen. Operation was performed urgently and an attempt was made to replace the abdominal contents by extensive mobilization of skin and division of muscle to gain skin cover for primary suture. However, ventilation was difficult and inadequate even before suturing was started. The defect was therefore bridged and closed with a pouch of silicone sheeting and a gastrostomy was established. Over the next 2 days there was considerable fluid loss around the edges of the silicone pouch, and so on the third day of life the silicone sheeting was removed. There were some pin-head sized areas of dubious blood supply on the exposed gut. This gut was disturbed as little as possible and a patch of lyophilized dura was stitched to the under-surface of the skin at the edge of the defect using mattress sutures. A central venous catheter was also inserted through the right internal jugular vein for total parenteral nutrition. Postoperatively the exposed dura was painted daily with mercurochrome solution.

After 10 days a small discharge appeared at the right side of the dural patch which had mummified and lifted off the underlying tissues. The exposed dura was therefore excised without anaesthesia. An enteric fistula was present but the rest of the exposed bowel was covered by a layer of healthy granulation tissue. Peripherally the dura was left intact where it had become vascularized to seal off the peritoneal cavity. Swabs taken from the exposed area grew no organisms on culture. The skin edge was then painted with mercurochrome solution and silver sulphadiazine cream was smeared over the exposed granulation tissue. Total parenteral nutrition was continued because of the fistula in the bowel. After 4 weeks the defect had closed except for the fistula. At 2 months of age the abdomen was explored and a length of 8 cm of atretic small bowel with adjacent fistulae was excised and anastomosis performed to restore intestinal continuity. Apparently the fistulae were precipitated by the atretic bowel. Subsequently the child was weaned gradually off intravenous feeding which had continued for 107 days. The child at 3 years of life is developing normally. The muscle layer of the abdomen appears to have closed as no defect edge can be felt and the abdominal contour is regular.

Case 2. A male infant with a birthweight of 2.4 kg was admitted on the day of birth under the care of a colleague who unsuccessfully attempted to close the gastroschisis defect after skin mobilization and muscle division. A silastic sac was therefore attached to the edge of the defect. The child's postoperative

course was stormy with tachypnoea and difficulty in maintaining a satisfactory arterial oxygen level. On the third day of life the child's general condition had deteriorated with peripheral circulatory collapse. Management was transferred to one of us (I.S.R.). The abdomen was tense and the child was shocked. Intestinal necrosis was suspected. After resuscitation the silastic sheeting was removed at a revision operation, when 5 cm of necrosed ileum was found about 10 cm from the ileocaecal valve. The apparent cause for this necrosis was a deep crease in the silastic sheeting which had impinged on the blood supply. The necrosed gut was excised. Further mobilization and muscle division was carried out, and as much of the small bowel contents as possible were milked out through the divided ileum to empty the gut. However, it was still impossible to close the skin and there was also difficulty in maintaining oxygenation of the patient. The two ends of ileum were therefore brought out onto the skin through a separate stab incision and a patch of lyophilized dura was sutured over the defect. A central venous catheter for total parenteral nutrition was inserted. Subsequently the exposed dura mummified and started to lift from the underlying bowel by the 12th postoperative day. It was then excised in the ward to reveal healthy granulation tissue beneath. This was smeared with silver sulphadiazine cream. By the 6th postoperative week the skin had closed over the granulations. Unfortunately the baby became a victim of an epidemic of enteritis due to pathogenic *E. coli* and died of septicaemia.

At necropsy the abdominal defect had healed over completely with epithelial tissue. As well as the *E. coli* being isolated from the blood before death it was also cultured post mortem from cardiac blood and a thrombus in the superior vena cava presumably provoked by the central venous catheter.

Discussion

Hecker (1972) has successfully used lyophilized dura in the primary operative treatment of gastroschisis. In our cases lyophilized dura was not used in the primary closure but replaced silastic sheeting after deterioration in the patient's condition. This was due to excessive loss of peritoneal fluid in the first baby and gut necrosis in the second child.

It is difficult to obtain a satisfactory seal round the edge of the defect when it is closed by silastic sheet, thus allowing excessive loss of peritoneal fluid and invasion of the peritoneal cavity by micro-organisms. In addition, necrosis in the underlying tissues may be the result of pressure from a fold of silastic sheeting. The advantage of dura is the

biological response to the material. The peripheral dura that is covered by skin becomes vascularized and seals off the peritoneal cavity. This seal is left as a protection against bacterial invasion and peritoneal fluid loss after the central part of the dural patch is removed. The application of a dural patch to the abdominal wall defect in gastroschisis makes the situation comparable to that of an omphalocele managed by the application of anti-septics. The dura not covered by skin mummifies after 10 to 14 days, by which time a protective layer of granulation tissue has grown across the underlying bowel. This mummified dura can then be removed in the ward and the exposed area covered with silver sulphadiazine cream. The technique is particularly appropriate for babies with intra-abdominal complications such as bowel necrosis or fistulae or where complications have occurred with the use of silastic sheeting. Its use as a primary procedure may well prove to have a place especially in the small preterm baby.

The disadvantage is the slow healing, comparable to that of exomphalos treated conservatively. However, babies with gastroschisis treated by other methods often require long periods in hospital because of the slowness of the bowel to develop normal mobility.

Summary

At the Royal Alexandra Hospital for Children, Sydney, we have found that primary closure in gastroschisis is usually successful. However, in a small number of cases such closure is found to be impossible. In such patients we have not been satisfied with silastic sheeting and have on two occasions successfully used lyophilized dura.

The lyophilized dura was obtained from B. Braun Melsunger, East Germany, under the trade name, Lyodura.

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