

Reconstruction of the Umbilicus Using a Reverse Fan-Shaped Flap

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Abstract. The goal of the reconstruction for umbilical absence is to obtain a natural three-dimensional appearance of the umbilicus with minimal operative scarring. This paper presents two cases of umbilical reconstruction using a reverse fan-shaped flap. In both cases, the umbilicus was lost during surgical procedures on the abdominal wall when the patients were newborns. We performed this technique in both cases. This technique is simple and safe. With this technique, a permanent umbilical depth and ring can be obtained without any complications.

Key words: Umbilical reconstruction—Local flap—Umbilical absence

Surgical procedures for umbilical cord hernias, gastroschisis, tumors of the abdominal wall, and trauma can result in the absence of the umbilicus. The umbilicus is located in the center of the abdomen, and it is often exposed in the child's community life at school and in recent fashions. Therefore, the number of cases of reconstruction for umbilical absence is increasing.

In children, however, it is difficult to reconstruct the umbilicus with sufficient depth because of the thin abdominal wall.

We have developed a new technique of reconstruction for umbilical absence and applied it in two cases using a reverse fan-shaped flap. It allows good cosmetic results.

Surgical Technique

The position of the new umbilicus is decided at the intersection of the xiphoid-pubic line and Jacob's line (Fig. 1A).

The size of the flap is $ab = cd = 7\text{--}10$ mm, $bc = 10\text{--}15$ mm. bc is the pedicle of the flap. The sum of $ab + bc + cd$ is the circumference of the umbilical ring. The length from bc to e is the depth of the umbilicus, and it is generally 17–20 mm. The bilateral slant-lined parts are excised area, because these parts become dog-eared (Fig. 1B). The flap is elevated at a superficial level within the subcutaneous tissue which includes the subdermal plexus. The lateral part of the flap is turned over and sutured between the dermis to create an upward tubular flap (Fig. 1C). The adipose tissue below the flap is excised as much as possible to create a deeper umbilical cavity (Fig. 1D). The tubular flap is then anchored to the linea-alba (Fig. 1E). After reconstruction of the umbilical cavity, the underskin is advanced upward to suture with the tubular flap, and the bilateral slant lined parts are excised. The reconstructed umbilical cavity is then fixed with a bolster (Figs. 1E and F).

Case Reports

Case 1

A 5-year-old boy's umbilicus was lost after an operation for gastroschisis while a newborn. A 7 × 3-cm wide scar is present in the upper part of the abdomen. A small umbilical cavity was seen in the wide scar, however, it was located too far up from the real umbilical position due to scar contraction (Fig. 2; top left). The operation was performed under general anesthesia. A reverse fan-shaped flap was elevated, creating a tubular flap (Fig. 2; top right). The tip of

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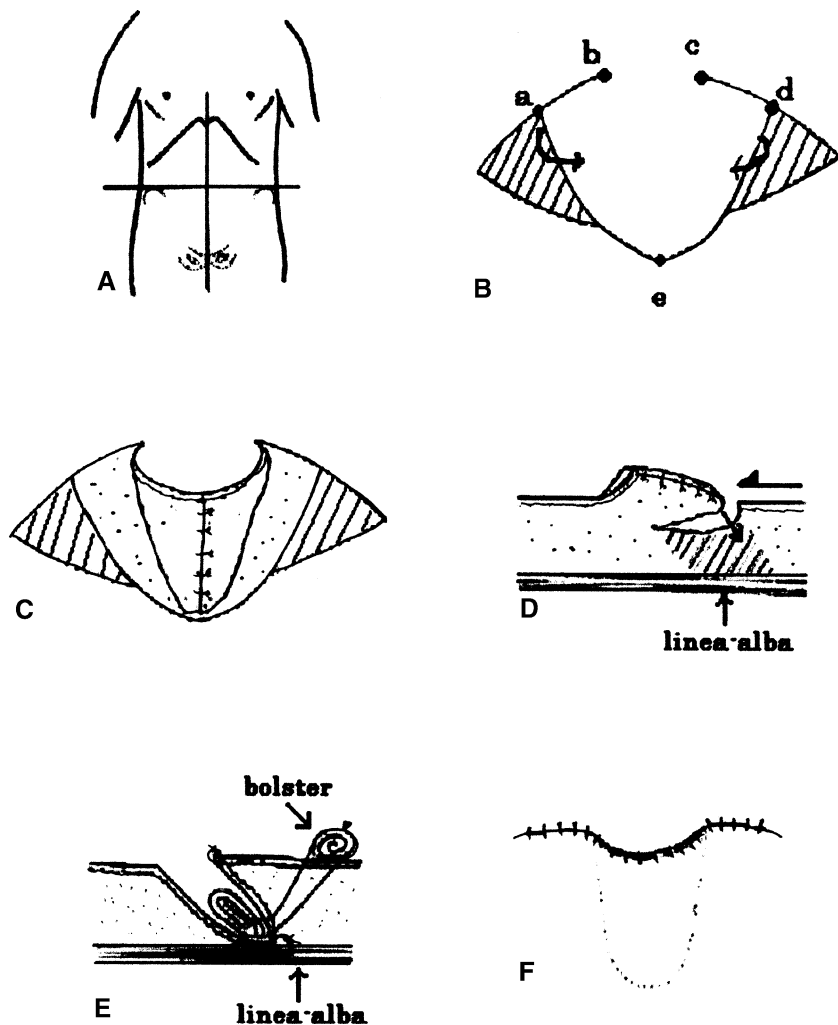


Fig. 1. A Position of the new umbilicus. B Design of the reverse fan-shaped flap. C The flap is created as an upward tubular flap. D Sagittal view of the flap. The adipose tissue below the flap (slant-lined area) is excised. E The tubular flap is anchored to the linea-alba and fixed with a bolster. F Postoperative view.

the tubular flap was anchored to the linea-alba. As for the flap design, $ad = cd = 7$ mm, $bc = 10$ mm, and bc to $e = 17$ mm. The bolster was removed 10 days after the operation. This patient was followed for 8 months, and flattening of the umbilicus was not seen. The reconstructed umbilicus had an excellent appearance. The patient and his parents are satisfied with the results.

Case 2

A 4-year-old boy presented with a flat umbilicus with a 1.5-cm transverse scar (Fig. 3, top left). He underwent a surgical correction for an umbilical cord hernia at birth. A similar procedure was performed. The flap size was $ab = cd = 7$ mm, $bc = 15$ mm, bc to $e = 17$ mm. At 10 days after the operation, the bolster fixation was removed. This patient was followed up for 8 months. The appearance of the umbilical ring and the umbilical depth were both maintained.

Discussion

The umbilicus is formed following the removal of the umbilical cord after birth. Its appearance is different from individual to individual. It has no function; however, it is very important for cosmetic reasons. Its appearance and reconstruction have therefore interested many plastic surgeons.

Cases of umbilical absence or deformity caused by umbilical cord hernias, gastroschisis, tumors, and trauma are not few. It is considered that umbilical absence or deformity causes great mental distress to patients suffering from this condition. Therefore, umbilical reconstruction is necessary.

When selecting the time of the operation, we should wait until the postoperative scar from the primary disease quiets down, and the rectus abdominis muscle and abdominal fat develop fully. However, in children, we consider that the operation should be performed before entrance into elementary school, because we must think about the patient's self-esteem and the parents' sensibilities.

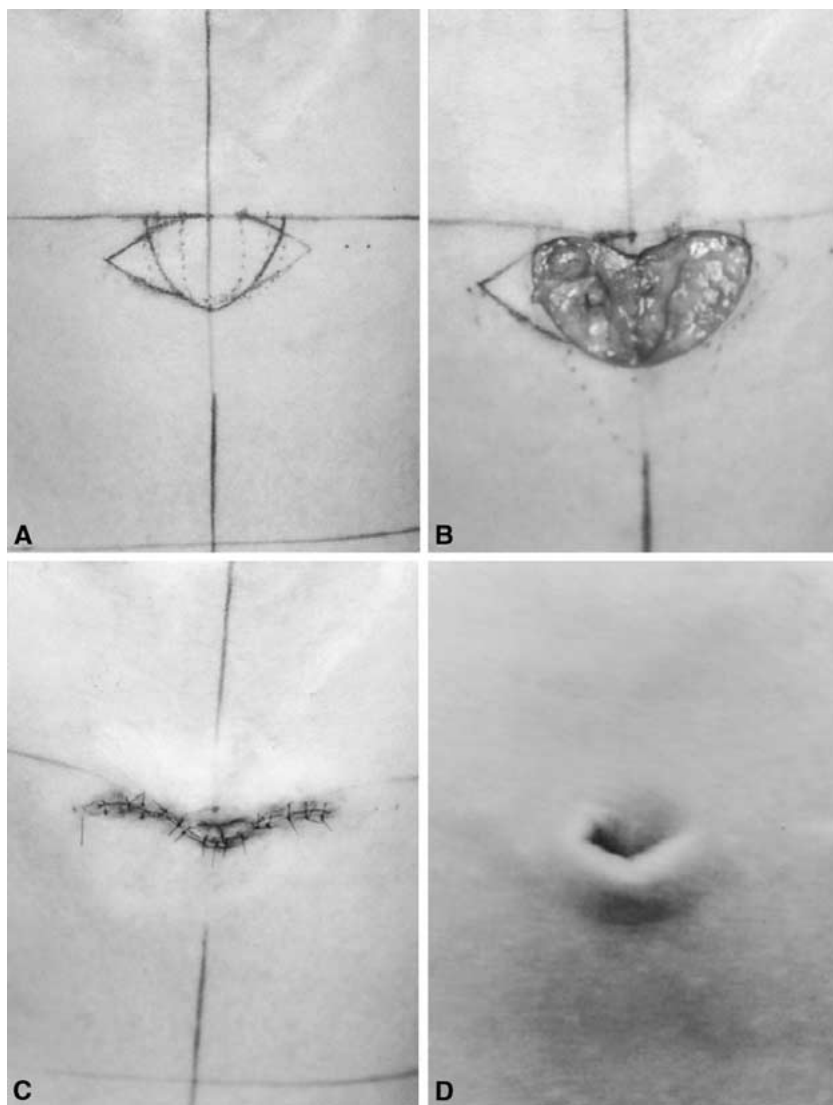


Fig. 2. Case 1. **Top left:** Preoperative view and design of the flap. **Top right:** The flap is turned over, creating a tubular flap. **Bottom left:** Appearance immediately after the operation. **Bottom right:** Appearance 8 months after the operation.

Kobayashi et al. [11] examined the umbilical position in 152 children between 0 and 11 years old. They described that it is placed within 1 cm of Jacob's line. Ohyama et al. [2] reported that the xiphoid–pubic line and the transverse line of the anterior superior iliac spine are useful to decide the new umbilical position. We based our procedure on Kobayashi's report.

Several techniques for umbilical reconstruction have been reported, using local flaps with skin grafts [3–6] or local flaps only [8–21], sometimes in combination with tissue grafts [7] (Table 1). In children, it is difficult to reconstruct the umbilicus with sufficient depth because of the thin abdominal wall. Techniques using skin grafts are outstanding methods for thin-abdominal wall cases. They can create a deep umbilicus in any case. However, the grafted skin contracts in the early stage after the operation, causing a loss of umbilical depth and deformity. When considering the use of local flaps only, they have to be

designed in a moderate size to create enough umbilical depth and an umbilical ring. However, if the flaps are too small so as to avoid a wide operative scar and deficiency of skin caused by flap elevation, it is difficult to ensure a sufficient result. Itoh and Arai [15] described an umbilical reconstruction using a cone-shaped flap to make the lateral walls of the umbilicus. Nakamura [12] also described the importance of reconstruction of the umbilical lateral walls by flaps. Ohjimi et al. [6] described that umbilical reconstruction should use thick flaps, and anchoring sutures to the linea-alba have to be used to keep a permanent umbilical depth.

The aim of every technique is to achieve a natural three-dimensional appearance. We also believe in the importance of umbilical lateral wall reconstruction and using anchoring sutures to the linea-alba.

Our procedure has three advantages. (1) A tubular flap can create a three-dimensional structure for the

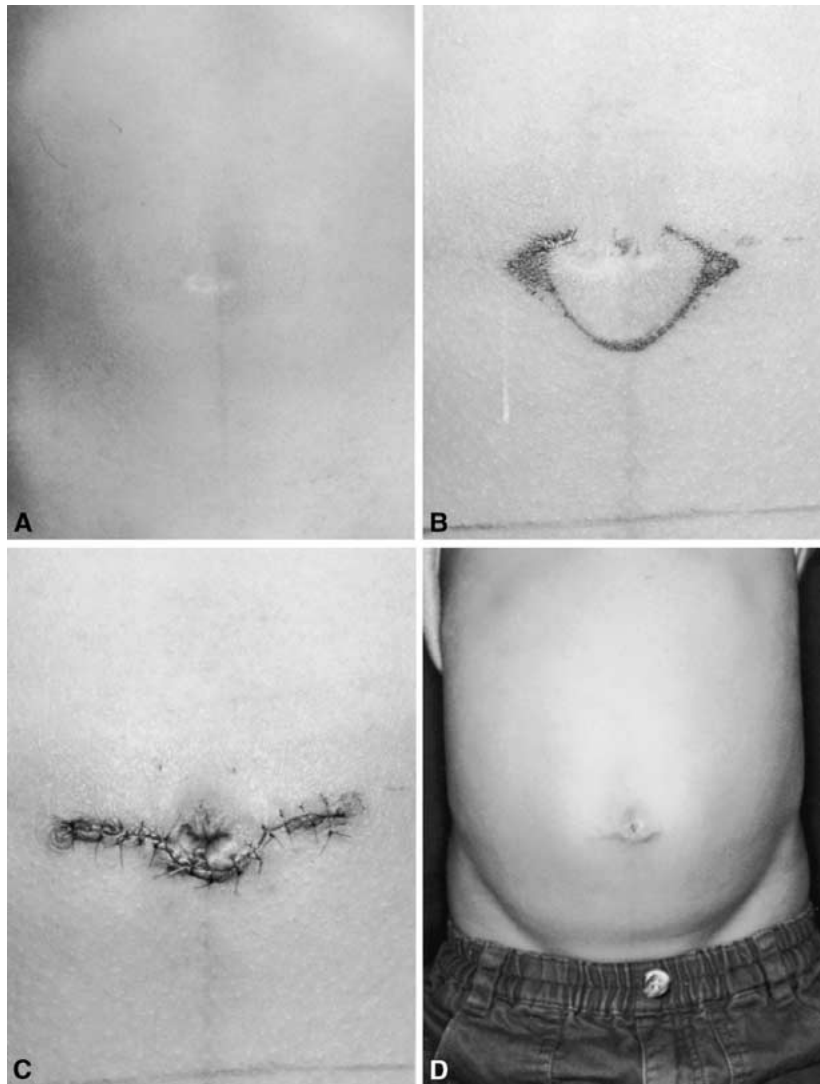


Fig. 3. Case 2. **Top left:** Preoperative view. **Top right:** Design of the flap. **Bottom left:** Appearance immediately after the operation. **Bottom right:** Appearance 8 months after the operation.

Table 1. Classification of umbilical reconstruction

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|--------------------------------------|--|---|
| Skin grafts + local flaps | Onizuka (1970) [5] Miyamoto (1984) [4] | Hatoko (1989) [3] Ohjimi (1989) [6] |
| Composite grafts local flaps only | Matsuo (1990) [7] Tange (1969) [8] Borges (1975) [9] Kirianoff (1978) [10] Fawzi (1979) [11] Kobayashi (1989) [1] Itoh (1992) [15] Miller (1993) [16] | Nakamura (1994) [12] Sawada (1995) [19] Sugawara (1995) [17] Onishi (1995) [18] Marconi (1995) [13] Yotsuyanagi (1998) [20] Shinohara (2000) [21] |

umbilical ring and lateral walls. (2) The visible operative scar is parallel to the abdominal wrinkle line, and its length is minimal. (3) The umbilical cavity and its depth are maintained by anchoring sutures to the linea-alba.

In our two cases, a three-dimensional umbilicus with sufficient depth was obtained without any complications such as flap necrosis. We believe that the method presented may also be considered quite satisfactory from an aesthetic standpoint.

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