Acta Biomed 2019; Vol. 90, N. 4: 504-509 DOI: 10.23750/abm.v90i4.7539

Update

Umbilical reconstruction: different techniques, a single aim

Marco Gardani[1, 2], Dante Palli[1], Francesco Simonacci[2], Michele Pio Grieco[2], Nicolò Bertozzi[2], Edoardo Raposio[2]

[1] Department of General Surgery, Breast Unit, Guglielmo da Saliceto Hospital, Piacenza, Italy; [2] Department of Medicine and Surgery, Plastic Surgery Division, University of Parma, Parma, Italy, and The Cutaneous, Mininvasive, Regenerative, and Plastic Surgery Unit, Parma University Hospital, Parma, Italy

Summary. The umbilicus is a unique physiologic scar of human life resulting from the healing process of the cut umbilical cord at birth. Its absence leads to an unnatural abdominal appearance, and an abnormally shaped or misplaced umbilicus may draw undue attention to the central abdomen. Loss of the umbilicus can be an embarrassing deformity; this occurs when older techniques of umbilical hernia or incisional hernia repair are employed and after abdominoplasty, urachal cyst repair, omphalocele repair, gastroschisis repair, some tumor excisions, and mobilization of bipedicled or bilateral TRAM/DIEP flaps for breast reconstruction. Umbilicoplasty, in which the umbilicus remains anchored to the deep abdominal fascia but is transposed through a newly-formed aperture in the upper abdominal skin flap, is performed in abdominoplasty either for abdominal flap harvest or purely for aesthetics. On the other hand, umbiliconeoplasty describes the de novo creation of an umbilicus that is absent for either congenital or acquired reasons. The optimal umbilical reconstruction should be reliable, reproducible, aesthetically appropriate, and associated with low morbidity. Ideally, it is also single-staged, except in the case of an infected wound, in which case a delayed primary approach may be prudent. (www.actabiomedica.it)

Key words: umbicoplasty, umbiliconeoplasty, plastic surgery

Introduction

The umbilicus is a unique physiologic scar of human life resulting from the healing process of the cut umbilical cord at birth. It is, therefore, the first scarring to occur over the course of a human lifetime. The umbilicus is usually a round to oval depressed structure with an average diameter of 1.5 to 2 cm (1) that greatly contributes to the aesthetic appearance of the abdominal wall. It also serves as a natural reference point, lying anatomically at the crossing of the midline and the line transecting the superior iliac crests (or just superior to this line) (2, 3).

Formation of the umbilicus results from the cancellation and retraction of the following four elements: the left umbilical vein, which heads superiorly towards the round ligament of the liver; the obliterated urachus, which directs inferiorly; and the two umbilical arteries, each of which runs laterally to the corresponding internal iliac artery (4, 5). The umbilicus defines the median abdominal sulcus and contributes to the curved shape of the inferior abdomen. Its absence leads to an unnatural abdominal appearance, and an abnormally shaped or misplaced umbilicus may draw undue attention to the central abdomen (6). Loss of the umbilicus can be an embarrassing deformity; this occurs when older techniques of umbilical hernia or incisional hernia repair are employed and after abdominoplasty, urachal cyst repair, omphalocele repair, gastroschisis repair, some tumor

excisions, and mobilization of bipedicled or bilateral TRAM/DIEP flaps for breast reconstruction (7-11).

Principles of reconstruction

Umbilicoplasty, in which the umbilicus remains anchored to the deep abdominal fascia but is transposed through a newly-formed aperture in the upper abdominal skin flap, is performed in abdominoplasty either for abdominal flap harvest or purely for aesthetics. Most surgeons use a circumumbilical incision to preserve the fixed umbilicus, passing it through a new orifice in the upper abdominal flap (2). Reinsertion of the umbilicus into the abdominal wall is performed through a circular, oval, vertical (12) or transverse (13) incision. On the other hand, umbiliconeoplasty describes the de novo creation of an umbilicus that is absent for either congenital or acquired reasons (14). The optimal umbilical reconstruction should be reliable, reproducible, aesthetically appropriate, and associated with low morbidity. Ideally, it is also single-staged, except in the case of an infected wound, in which case a delayed primary approach may be prudent. Umbiliconeoplasty may be performed using any number of techniques and may include the use of flaps or grafts or healing by secondary intention (15).

Surgical techniques

Umbilicoplasty

Abdominoplasty is a common body contouring procedure with numerous reported options for umbilical management. The earliest reports in the literature described excision of the umbilicus en masse with the abdominal pannus, with or without its replacement as a graft (14, 16). Moreover, even recent reports describe umbilical sacrifice as part of abdominal pannectomy, usually in the case of a particularly large pannus and elongated umbilicus that is unlikely to survive transposition due to vascular insufficiency (17). Others describe de-epithelialization of the umbilicus with dermabrasion, followed by the creation of a scar-free umbilical depression through the securing of a circular, defatted area of the abdominoplasty flap to the umbilical base (18).

Umbiliconeoplasty with external scars

The scars are placed in variable directions. Such scars, generally of good quality, constitute a disadvantage, but sometimes allow mobilization of adjacent skin in a more effective way for reconstructing a three-dimensional navel.

Abdominal flaps

Borges Technique

Borges (19) proposed excision of a quadrilateral segment of skin on each side of the navel for umbilical reconstruction. The median angles are positioned approximately 1 cm away from each other at a 60° angle to create a reverse scar after suturing the excised area. The side angles are very sharp to prevent the formation of dog ears. The excised surface differs from one patient to another. This technique can be improved by adding two local lateral flaps taken from the quadrilateral segments. This technique has the disadvantage of sacrificing skin on the site to be used for reconstruction and risks creating a shallow navel with a long horizontal scar.

C-V flap technique

Shinohara et al. (20) reported an umbilical technique in which there are two V-flaps and a C-shaped flap that are sutured in a tubular manner. This technique allows for the deepening of a non-invaginated adherent scar umbilicus. The technique begins with the drawing of two lateral triangular flaps and a lower C-shaped flap. The pedicle of the three flaps is superior. The depth of the navel depends on the width of the base of the "V", and the diameter depends on the diameter of the "C". The V- and C-flaps are sutured together to create an invaginated tube. The donor sites of the V-flaps are sutured, and the rotated tubular flap is anchored in the lower midline with sutures on the package. A dressing is inserted into the reconstructed navel for about two weeks. This technique seems to be

most adapted for lean patients and children. Its main drawback is a horizontal scar outcome.

Modified "unfolded cylinder" technique

This technique, described by Ozbek et al. (21), is similar to the C-V flap technique, but has a very precise pre-operative design. It involves the inverse application of an "unfolded cylinder", which was previously described for nipple reconstruction. After delineation of the umbilical position, an "open cylinder" is drawn with a horizontal rectangle over an oval. The upper margin of the rectangle is located 1.25 cm above the midpoint. The vertical and horizontal rays of the ellipse are 2.5 and 2 cm, respectively. The width of the rectangle is as great as the thickness of the subcutaneous fatty tissue. The length of the rectangle is three times longer than the vertical radius of the ellipse (7.5 cm). The ellipse is drawn in the central third of the lower edge of the rectangle, being slightly included in the rectangle itself. The incisions follow the drawing with respect to the middle third, which constitutes the upper pedicle. The flaps are raised and defatted. Resorbable sutures are used to reconstruct the cylinder, whereas the bottom is fixed in depth with non-absorbable sutures. The donor site is sutured directly with resection of residual dog ears if necessary, and the neo-navel is filled with gauze. The advantage of this technique is that the appropriate depth of the neo-navel can be easily achieved.

Lunch box-type technique

Onishi et al. (22) described a technique of navel reconstruction using a local flap with a lower pedicle design that resembles a seed. The end of the flap is divided into two, and the two parts serve as the upper and lateral walls of the neo-navel. The umbilical depth is a function of the flap width. The whole flap is defatted and the middle surface "E" represents the bottom of the navel, whose size and shape can be freely designed. A suture is then made between points "A" and "A'" and between points "B" and "B'" for skin invagination. The flaps "C" and "D" are sutured giving the umbilicus the form of a lunch box. The superior donor site is sutured directly. A slightly compressive bandage is applied for 7 days. This technique also has similarities to the techniques described above in that the defatted umbilical bottom and two flaps make a tube. However, the lunch box-type technique may be associated with a shallow navel.

V-Y flap technique

Jamra (23) proposed an umbilical reconstruction technique using two V-shaped flaps in which one flap's base is adjacent to the apex of the other. After collection, the flaps are defatted and laterally displaced in opposite directions, and their ends are sutured to each other and the abdominal fascia. The remaining incisions are sutured after correction of the dog ears. This technique produces a deep adherence that simulates a navel, although it often results in a narrow umbilicus.

Twisted flaps technique

Yotsuyanagi et al. (24) described an umbilical reconstruction technique using two vertical rectangular flaps that are sutured to each other, tubulated and twisted with a single deep stalk. Two small lateral flaps are then laterally invaginated. The donor areas and the dog ears are sutured directly. This flap is particularly suitable for cases with medial laparotomy scars and can be performed without creating an additional scar.

Triangular flap technique

This technique, described by Pfulg et al. (25), involves creating a vertical or horizontal triangular flap drawn on an excised vertical cutaneous strip. The base of the triangle is located at the edge of the excised strip and measures about 4 cm, whereas the other two margins measure 7 and 6 cm. After excision of the adipose tissue of the umbilical reconstruction unit, the flap is folded and sutured on itself. The end of the conical flap is fixed to the abdominal fascia with resorbable 2.0 thread suture. The cutaneous excess around the neo-navel is resected and sutured vertically. A drawback of this technique is the length of the vertical scar and the wide excision that produces scars of poor quality, but neo-navels with good depth.

Iris technique

This technique was described by Miller (8). Around a circular area of missing tissue, four arciform local flaps are drawn. The flaps are symmetrical with a base of 1.5 cm and a length equivalent to a quarter of the circumference of the absent circular tissue. After mobilization, the ends of the flaps are sutured together and fixed to the abdominal wall with non-resorbable suture. The adjacent margins of the flaps are brought together so that they are rotated. The dog ears are immediately corrected. This technique creates a shallow navel and is indicated for primary or secondary reconstructions.

Umbiliconeoplasty without external scars

Double-C technique

The double-C technique was described by Illouz et al. (26) for immediate reconstruction after abdominal dermolipectomy in monobloc. It consists of drawing a circle 2 cm in diameter instead of a neo-navel. Two opposite semicircular flaps in the shape of an open C are drawn. Then, after excision of small upper and lower triangles, the two flaps are defatted, sutured to each other and fixed to the aponeurosis. A dressing based on fat gauze is maintained for 10 days. The double-C technique is simple and very useful for umbilical reconstruction in healthy skin.

Purse-string suture techniques

One example of this type of technique, described by Schoeller et al. (27) and Meirer et al. (28), is used for immediate umbilical reconstruction. Once the navel is excised, a 2 cm wide ring is drawn around the defect and defatted with scissors, preserving the subdermal vascular plexus. At the level of the deep face of the dermis at the defatted ring's outer circumference, a purse-string suture is made with non-resorbable thread. A second, shoulder, suture is made at the free dermal margin of the ring. Before tightening the two sutures, a third thread is passed that includes the skin margin at 3 and 9 o'clock and is perpendicular to the drawn line. The peripheral purse string suture is carefully pulled until the diameter of the rim decreases from 6 to 2 cm. This maneuver creates skin folds and invaginates the skin ring. The second central suture is then completely tightened and fixed to the sunrise line, imitating the bottom of the umbilical crater. The third thread is then knotted by taking a Vaseline gauze and fixing it equally on the sunrise line at the bottom of the navel.

Mateu et al. (29) described a similar technique using only one purse-string suture, but with a third defatted flap. Schwartz (30) proposed immediate umbilical reconstruction with the positioning of a purse string suture around the circular defect of the umbilicus. This suture is adjusted until the desired umbilical dimension is obtained. More sutures are then used to fix the cutaneous margins to the abdominal wall, and the bottom of the crater is left to heal by secondary intention. A drawback of this technique is that a wound persists at the end of the procedure which requires regular dressing care; an advantage is that it allows the centripetal folds and the skin tension to be decreased.

Double circle technique

The "double circle" technique described by Baack et al. (4) begins with the marking of a point on the median line of the abdomen at the top of the iliac crest. Around this point a 1 cm diameter circle and another 2.5 cm diameter circle are drawn. The skin incision is made transversely at the level of the large circle equator, preserving the smaller circle surrounded by an incised upper semicircle. The upper and lower flaps are freed to the limit of the outer circle. The inner circle of the lower flap is completely defatted and anchored with points on the deep plane to provide a large contact surface between the dermis and fascia. Then, the two upper flaps are reassembled and sutured to the band and the inner circle. Approaching points "A" and "B" creates an umbilical depression. A Vaseline gauze is placed in the depression and kept in place for 5 to 7 days. This simple technique allows one to create good umbilical adhesion, but a shallow neo-navel.

Marconi's technique

Marconi (31) has proposed a simple technique for umbilical reconstruction. The new position of the navel

is found on the abdomen in an upright position. The neo-navel is designed according to a horizontal elliptical shape of 2 × 2.5 cm. Once the peripheral incision has been made, a precise excision of the subcutaneous adipose tissue of the flap is performed, preserving the musculocutaneous perforating vessels. Subsequently, a bag suture with non-resorbable thread is made on the outer edge surrounding the "island" flap. Prolène® points fix the margins of the inner flap to the muscular plane and the outer margins. A mold dressing is placed for 4 weeks, and the sutures are removed after 2 weeks. The final scar has an elliptical appearance without an external scar. However, the defatting of the flap with preservation of the perforators is a delicate point with this technique, which entails the risk of non-negligible necrosis.

Umbiliconeoplasty with grafts

Abenavoli et al. has described the use of a full-thickness skin graft for the base of the neo-navel (32). The side walls are reconstructed using laterally based abdominal advancement flaps. Matsuo et al. have favored a graft of conchal cartilage (33). The upper wall of the navel is created by flap advancement, and the lower wall is made using a cartilage graft. The ear donor unit is closed with a rear ear flap. This technique involves the risks of failure of graft implantation and infection. The reconstructed navel has an unnatural rigidity.

Complications

Data on complications after umbilical reconstruction are lacking in the international literature. However, we have observed complications such as umbilical stenosis, umbilical or skin flap necrosis (34), scar hypertrophy and transient skin erythema. Furthermore, at times a deep neo-navel cannot be achieved, resulting in a flat umbilicus. Moreover, in some cases, patients report hypo- or insensitivity around the neo-umbilical scar.

Discussion

Umbilical reconstruction is performed in a variety of clinical situations; reconstruction may be needed in cases with lost skin, healthy skin, or cicatricial skin. Having knowledge of all the different reconstruction techniques allows one to select the most suitable technique with the best safety profile and least amount of scar potential for each case. Many techniques for reconstruction have been reported in the literature, but the goal of each is to create a natural-appearing umbilicus with a permanent and sufficient depression with minimal scarring (35, 36). Although the ideal shape of the umbilicus has been debated, recent studies have shown that the young, thin female with an attractive abdomen tends to have a small, vertically oriented umbilicus (37). The multitudinous procedures described above offer a wide range of choices; however, few authors have performed large or comparative studies, so the choice is often a personal one based on the limited experience of the surgeon. The lack of studies on umbiliconeoplasty as well as the wide variety of possible procedures suggests a lack of familiarity with this problem in many surgeons. A lack of recognition of this problem among surgeons may also play a role (38).

Conflict of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

References

1. Visconti G, Salgarello M. The Divine Proportion "Ace of Spades" Umbilicoplasty A New Method of Navel Positioning and Plasty in Abdominoplasty Ann Plast Surg 2016; 76: 265-269.
2. Vernon S. Umbilical transplantation upward and abdominal contouring in lipectomy. Am J Surg 1957; 94: 490.
3. Ramirez OM. Abdominoplasty and abdominal wall rehabilitation: a comprehensive approach. Plast Reconstr Surg 2000; 105: 425.
4. Baack BR, Anson G, Nachbar JM, White DJ. Umbilicoplasty: the construction of a new umbilicus and correction of umbilical stenosis without external scars. Plast Reconstr Surg 1996; 97: 227-232.
5. Dick ET. Umbilicoplasty as a treatment for persistent umbilical infection. Aust N Z J Surg 1970; 39: 380-383.
6. Mazzocchi M, Trignano E, Armenti AF, Figus A, Dessy LA. Long-Term Results of a Versatile Technique for Umbilicoplasty in Abdominoplasty. Aesth Plast Surg 2011; 35: 456-462.
7. Gardani M, Bertozzi N, Grieco MP, et al. Breast reconstruction with anatomical implants: A review of indications and

techniques based on current literature Annals of Medicine and Surgery 2017; 21: 96-104.
8. Miller MJ, Balch CM. Iris Technique for immediate umbilical reconstruction Plastic and reconstructive surgery 1993; 92: 754-756.
9. Grieco M, Grignaffini E, Simonacci F, Di Mascio D, Raposio E. Post-bariatric body contouring: our experience. Acta Biomed 2016; 87: 70-75.
10. Grignaffini E, Grieco MP, Bertozzi N, et al. Post-bariatric abdominoplasty: our experience. Acta Biomed 2015; 86: 278-282.
11. Lo Conte D, Bertoglio C, Magistro C, et al. Topic: Incisional Hernia - Plastic surgery aspects. Hernia 2015; 19 Suppl 1: 246-247.
12. Lee MJ, Mustoe TA. Simplified technique for creating a youthful umbilicus in abdominoplasty. Plast Reconstr Surg 2002; 109: 2136-2140.
13. Choudhary S, Taams KO. Umbilicosculpture: a concept revisited.Br J Plast Surg 1998; 51: 538-541.
14. Baroudi R. Umbilicaplasty. Clin Plast Surg 1975; 2: 431-438.
15. Southwell-Keely JP, Berry MG. Umbilical reconstruction: A review of techniques Journal of Plastic, Reconstructive & Aesthetic Surgery 2011; 64: 803-808.
16. Thorek M. Plastic reconstruction of the female breasts and abdomen. Am J Surg 1939; 43: 268-278
17. Santanelli F, Mazzocchi M, Renzi L. Reconstruction of a natural looking umbilicus. Scand J Plast Reconstr Surg Hand Surg 2002; 36: 183-185.
18. Schoeller T, Wechselberger G, Otto A, et al. New technique for scarless umbilical reinsertion in abdominoplasty procedure. Plast Reconstr Surg 1998; 102: 1720-1723.
19. Borges AF. Reconstruction of the umbilicus. Br J Plast Surg 1975; 28: 75-76.
20. Shinohara H, Matsuo K, Kikuchi N. Umbilical reconstruction with an inverted C-V flap. Plast Reconstr Surg 2000; 105: 703-705.
21. Ozbek S, Ozcan M. Umbilicus reconstruction with modified 'unfolded cylinder'technique. Br J Plast Surg 2005; 58: 500-503.
22. Onishi K, Yang YL, Maruyama Y. A new lunch box-type method in umbilical reconstruction. Ann Plast Surg 1995; 35: 654-656.
23. Jamra FA. Reconstruction of the umbilicus by a double V-Y procedure. Plast Reconstr Surg 1979; 64: 106-107
24. Yotsuyanagi T, Nihei Y, Sawada Y. A simple technique for reconstruction of the umbilicus, using two twisted flaps. Plast Reconstr Surg 1998; 102: 2444-2446.
25. Pfulg M, Van de Sijpe K, Blondeel P. A simple new technique for neo-umbilicoplasty. Br J Plast Surg 2005; 58: 688-691.
26. Illouz YG. En bloc abdominoplasty : a new, safer and more esthetic technique. Ann Chir Plast Esthet 1990; 35: 233-242
27. Schoeller T, Rainer C, Wechselberger G, Piza-Katzer H. Immediate navel reconstruction after total excision : a simple three-suture technique. Surgery 2002; 131: 105-107
28. Meirer R,Wechselberger G, Schoeller T. Purse-string method for immediate umbilical reconstruction. Plast Reconstr Surg 2004; 114: 831-832.
29. Pardo Mateu L, Chamorro Hernandez JJ. Neoumbilicoplasty through a purse-string suture of three defatted flaps. Aesthetic Plast Surg 1997; 21: 349-351.
30. Bartsich SA, Schwartz MH. Purse-string method for immediate umbilical reconstruction. Plast Reconstr Surg 2003; 112: 1652-1655.
31. Marconi F. Reconstruction of the umbilicus : a simple technique. Plast Reconstr Surg 1995; 95: 1115-1117.
32. Abenavoli FM, Cusano V, Cucchiara V. An idea for umbilicus reconstruction. Ann Plast Surg 2001; 46: 194.
33. Matsuo K, Kondoh S, Hirose T. A simple technique for reconstruction of the umbilicus, using a conchal cartilage composite graft. Plast Reconstr Surg 1990; 86:149-151.
34. Grieco M, Grignaffini E, Simonacci F, Raposio E. Analysis of Complications in Postbariatric Abdominoplasty: Our Experience. Plast Surg Int vol. 2015, Article ID 209173, 5 pages, 2015. doi: 10.1155/2015/209173
35. Massiha H, Montegut W, Phillips R. A method of reconstructing a natural-looking umbilicus in abdominoplasty. Ann Plast Surg 1997; 38: 228-231.
36. Brown ES. The umbilicus as sexual focus. Int J Psychoanal 1997; 78: 577-578.
37. Craig SB, Faller MS, Puckett CL. In search of the ideal female umbilicus. Plast Reconstr Surg 2000; 105: 389-392.
38. Ricci JA, Kamali P, Becherer BE, et al. Umbilical necrosis rates after abdominal-based microsurgical breast reconstruction journal of surgical research 2017; 215: 257-263

Received: 16 July 2018
Accepted: 15 October 2018
Correspondence:
Marco Gardani MD,
Department of General Surgery, Breast Unit,
Guglielmo da Saliceto Hospital,
Via Taverna 49 - 29121 Piacenza, Italy
Tel. +393283027424
Fax +390523303153
E-mail: marco.gardani@hotmail.it