

## Original Research Article

# Flaps versus skin grafts in neovagina creation for vaginal agenesis

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### ABSTRACT

**Background:** Women with congenital uterovaginal agenesis have normal development of all secondary sexual characteristics. They face the cruel fact of being unable to bear children and enjoy sexual satisfaction. Good neo vaginal reconstruction is important in improving functional and psycho social impacts to womanhood. The aim of the study was to compare the three commonly done surgical procedures for vaginal reconstruction.

**Methods:** All the vaginal agenesis patients who attended Department of plastic surgery Madras Medical College, Chennai during the period from August 2004 to April 2007 were included in our study.

**Results:** In Abbe McIndoe procedure, graft take was full in all 7 cases with good cosmetic appearance. Flaps survived in all 10 patients underwent pudendal thigh flap surgery. 2 patients underwent horse shoe shaped labia minora flaps. The cosmetic appearance was fair because of the distortion of the labia. The mean vaginal depth obtained was 8 cm and width was 2 cm.

**Conclusions:** Cosmetic appearance was good in patients who underwent McIndoe procedure as the genitalia were not distorted. Contracture rate was more in patients who underwent McIndoe procedure especially who were irregular in using stents. Flap procedure especially pudendal thigh flaps which has the least contraction rate is the preferable treatment option for such patients.

**Keywords:** Absence of vagina, Creation, Cosmetic appearance, Mullerian agenesis, Reconstructive surgical procedures, Skin graft, Vaginal cavity

### INTRODUCTION

Congenital absence of vagina occurs in 0.001 to 0.025 percent of population.<sup>1</sup> Incidence is 1:5000 to 1:10000 live births.<sup>2</sup> It is the main noticeable manifestation of Rokitansky sequence.<sup>3</sup> The primary defect is the disturbance in the development of the caudal end of paramesonephric ducts.<sup>4</sup>

The patients usually are first seen by a gynaecologist at age 14 to 15 years, when the absence of menses causes concern. They have a normal complement of chromosomes (46, XX) and usually have normal ovaries and secondary sex characteristics, including external genitalia. Menstruation does not appear at the usual age

because the uterus is absent, but ovulation occurs regularly.<sup>5</sup>

Vaginal cavity is created by incising in the vaginal dimple and creating the space between bladder and rectum. The literature indicates have more than 100 methods for vaginal reconstruction and still we are looking for a more effective method as in Table 1.<sup>5</sup>

The objective of our study was to suggest a procedure which can be practiced and performed for Indian patients considering their need, awareness, cooperation for post-surgical stenting, technical considerations and cosmetic appearance. In our study we have tried to compare three surgical techniques and arrive at better understanding of this rare but complicated disease.<sup>6</sup>

**Table 1: Classification of methods to form neo vagina.**

Methods	Type	Sub type	Procedures
<b>Non surgical</b>			Frank's technique Ingram's technique
		Without cavity dissection	Constant pressure (vechiette) Vulvovaginoplasty (William's, O'Brien's) Combined
<b>Surgical</b>	With cavity dissection	No lining	No lining
		Lining with grafts	Split thickness skin graft Full thickness skin graft Dermis graft Buccal mucosal graft Bladder mucosal graft Amnion Peritoneum
		Lining with skin flaps	Labial skin after tissue expansion Labia majora skin Labia minora skin Subcutaneous pedicled skin flaps
		Lining with fasciocutaneous flaps	Perineal artery axial flap Malaga flap Neurovascular pudendal flap Modified Singapore flap
		Lining with musculocutaneous flaps	Gracilis myocutaneous flap Rectus abdominis flap Vulvobulbo cavernosus flap
		Lining with intestine	Jejunum Ileum Caecum Sigmoid colon Rectum
		Micro vascular reconstruction	Jejunum Scapular skin

**METHODS**

All the vaginal agenesis patients who attended our Department of Plastic surgery Madras Medical College, Chennai during the period from August 2004 to April 2007 were included in our study. Other cases such as testicular feminization syndrome, ambiguous genitalia, and intersex and androgen insensitivity syndrome were excluded from our study. Thorough history taking and physical examination were done to find the cause of primary amenorrhea and associated anomalies. The necessary investigations such as Karyotyping, ultra sonogram of abdomen, kidneys and pelvis were done to confirm the diagnosis and to find associated anomalies. The diagnostic laparoscopy was done. The patients were given counselling regarding the diagnosis and possible treatment outcomes.

Our department had three surgical units. The study is designed as the patients of first surgical unit underwent neurovascular pudendal thigh flaps, the patients of second surgical unit underwent labia minora flap and patients from third surgical unit underwent Abbe McIndoe

procedure. As the surgical procedures were already established and accepted procedures, the ethical clearance was not needed. The proforma for the collection of data was made. All the details of the patient during preoperative, surgical, postoperative and follow up periods were collected and analyzed. The post-operative results were analysed for a total of 14 points, composed of five points for the physical examination and nine points by the questionnaire. By physical examination we determine vaginal cavity depth and width, mucous discharge, malodour and cosmetic configuration. The questionnaire included sexual intercourse, use of lubricant, use of vaginal stent, abdominal pain, pain during intercourse, orgasm, problems in urination, problems in defecation and vaginal bleeding during intercourse. Since the incidence is low the number of patients underwent the study was also less. Meta analysis of all collected data was done and systematic review of comparison of results with other published articles was done.

24 patients underwent our study. 5 patients (20.8%) did not want surgery. Of them youngest was 13 years and the

oldest was 30 years old. 3 patients were not married and 2 patients were married. All the patients were explained about various treatment modalities available, but they refused surgery. They were very reluctant about trying dilation technique also. They did not come for follow-up after diagnosis. The mean vaginal dimple was 2 cm in non married and 3 cm in married group. The married patients had attempted sexual intercourse but painful in 1 patient.

For patients who underwent surgery the first step was the preparation of the vaginal cavity. Under spinal anaesthesia patient was placed in the lithotomy position. An inverted "V" shaped incision was made in the vaginal dimple. Then a space between the bladder and rectum was created by both blunt as well as sharp dissection. A finger in the rectum will guide the correct plane of dissection. A cavity of size about 10 to 14 cm length was created. Haemostasis achieved and the cavity was temporarily packed. Second step of surgery was done by the technique decided pre operatively according to surgeon and patient's choice. In our institution we perform three surgical procedures namely Abbe McIndoe, Neurovascular pudendal thigh flaps and Horse shoe shaped labia minora flaps.

In Abbe McIndoe procedure, two sheets of skin grafts were harvested from the medial aspect of inner thigh. The skin grafts were placed inside out with raw area exposed outside over the conformer made of dental wax. Skin grafts were sutured to each other and to the wound edges. Then the labia majora were sutured together. Postoperatively patient was kept bedridden for five days. On the fifth post-operative day labial sutures were cut, the stent was gently removed, leaving the skin graft intact. The vaginal stent was removed, cleaned and reapplied every other day. The catheter was removed on 8<sup>th</sup> or 10<sup>th</sup> post-operative day and patient was discharged.

If the neurovascular pudendal thigh flap procedure was selected two flaps of size about 10x4 cm was marked on the groin crease lateral to the hair bearing area of the labia majora. The base of the flap is at the level of the posterior end of the introitus. Flap was raised in subfascial plane. The epimysium of adductor muscle was included. The posterior skin margin was incised through the skin only. The labia were elevated off the pubic rami and the flaps were tunnelled underneath. Posterior suture line was completed first and then anterior suture line. The tip was anchored to the pelvic structures. Donor areas were primarily closed. Vaginal plug was kept. The labia were sutured together. Thighs were kept adducted. On the fifth postoperative day labial sutures were removed under sedation flaps were inspected. Vaginal conformer made of dental wax was kept. The patient was discharged on the 8<sup>th</sup> or 10<sup>th</sup> postoperative day after removing the catheter.

If the procedure selected was horse shoe labia minora flap, a horse shoe shaped fasciocutaneous flap including

both labia minora and the preputial skin was planned. The labia minora skin is hairless. The flap is elevated as a fasciocutaneous flap. The tubed flap is tunnelled into the space and retained with an apical vicryl suture. A non adherent gauze stent kept. On the fifth post-operative day labial sutures were removed, flaps inspected and stent kept. The patient was discharged on the 8<sup>th</sup> or 10<sup>th</sup> postoperative day after removing the catheter.

The patient was advised to remove, wash and reintroduce the conformer daily at home. The patient was reviewed at 1<sup>st</sup>, 2<sup>nd</sup>, 6<sup>th</sup> and 12<sup>th</sup> month postoperatively and then once in a year. The follow up was performed by physical examination and interview.

## RESULTS

A total of 24 patients underwent our study. Karyotyping was done for all patients. (46xx) pattern was found in all patients. Diagnostic laparoscopy was done for all patients. 8 patients (33.3%) had detectable anomalies in ovaries and 15 patients (62.5%) had anomalies in fallopian tubes, which are more than average percentage quoted in the literature.

5 patients (20.8%) did not want surgery.

7 patients (29.1%) underwent Abbe McIndoe procedure in our study. The youngest patient was aged 18 years and oldest 22 years. 3 patients were married before surgery. 4 patients were not married and 1 patient got married 3 months after surgery. All 7 patients did not have functioning uterus segment proximally. The operating time was between 75 to 120 minutes. Graft take was full in all cases. There were no significant postoperative complications except in one patient, contracture of cavity occurred which necessitated manipulation. Vaginal cavity width obtained was 2 cm in all cases. Vaginal cavity depth were 10 cm in 1 case, 9 cm in 2 cases, 8 cm in 3 cases and 7.5 cm in 1 case ( mean depth- un married 7 cm and married 8 cm). Mucus discharge and malodour were present immediately after surgery, but reduced to minimum with a month. Cosmetic appearance was good in all cases. All 3 married patients and 1 patient got married 3 months after surgery started sexual intercourse 3 months to 6 months post operatively. Lubrication was needed in all cases. All married patients used stent for 3 to 5 months postoperatively. All married patients discontinued stent at 6 months postoperatively. None of the married patients had abdominal pain or pain or bleeding during inter course. 1 patient only had orgasm during inter course. None had difficulties in defecation or urination. All 3 unmarried patients used lubricants and stent at 6 months post operatively. None had difficulties in defecation or urination. 1 patient, who had abdominal pain preoperatively, had pain after surgery.

10 patients (41.6%) underwent neurovascular pudendal thigh flap surgery. The youngest patient was 12 years and the oldest was 30 years old. 6 patients were unmarried

and 4 patients were married. The operating time was between 120 to 150 minutes. Flaps were posteriorly based in 9 patients and anteriorly based in 1 patient. Flaps measured 8 to 10 cm in length and 3 to 4 cm in breadth. The smallest flap was 8x3 cm and the largest flap was 10x4 cm in dimension. All the flaps survived no flap necrosis. Complications were 1 case of donor wound dehiscence for which secondary suturing was done, 1 patient had hematocolpos which required drainage and 1 patient developed pelvic abscess two months later which required drainage. 1 patient had menarche 3 months after surgery. The mean vaginal depth obtained was 8 cm and width was 2 cm. 1 patient had persistent mucus discharge and malodour. The cosmetic appearance of the neo vagina was fair, the colour of the flap skin was obviously noticeable, the hair growth was not appreciable and the donor scar was noticeable. All 4 married patients started sexual intercourse 4 to 5 months after surgery. All were using lubricants but discontinued stenting. None of the married patients had abdominal pain, pain or bleeding during intercourse, orgasm or difficulties in urination and defecation. 3 unmarried patients had abdominal pain post operatively.

2 patients (8.3%) underwent horse shoe shaped labia minora flaps. 1 patient was unmarried and aged 20 years, and 1 patient was married and aged 28 years. The operating time was between 150 to 180 minutes. For the unmarried patient 8x3 cm flap was taken and the flap survived without any complications. The postoperative vagina was 8 cm deep and 2 cm wide. Mucus discharge and malodour was present. The cosmetic appearance was fair because of the distortion of the labia but no donor scar was seen. The patient was using the lubricant and

stent. For the married patient 8x3 cm flap was taken but post operatively contracture of vagina occurred. Mucus discharge and malodour was present. The depth of the resultant vagina was 6 cm and width was 2 cm. The cosmetic appearance was fair because of the distortion of the labia but no donor scar was seen. The patient was using the lubricant and stent.

**DISCUSSION**

Non operative methods were offered for 5 patients (20.8%) who were not willing for surgical management. Ingram had 20 successful and 6 failed cases between 1975 and 1980. The technique took 4 to 6 months to achieve an adequate vagina.<sup>7</sup> An adequate vaginal canal was achieved in 91.9% patients in one study. Passive dilation failed in 8.1% patients. The average time taken to achieve successful dilation was 12 months.<sup>8</sup> We found this technique is not acceptable procedure in our patients, as this need a highly motivated patient with good intelligence. Moreover it takes considerable time to form vagina.

7 patients (29.1%) underwent Abbe-McIndoe procedure in our study. Our study results were compared with other studies in Table 2. Graft take was full in all cases. Graft take were 96% in Alessandrescu et al 1996 study and 90.6% in Seccia et al 2002 study.<sup>9,10</sup> The mean vaginal depths were 7 cm in unmarried group and 8 cm in married group which is also comparable to other studies.<sup>9,11-17</sup> This procedure is used as life boat in failures of dilation therapy and labia minora flaps.<sup>17,18</sup> This procedure was also compared with other procedures like Williams procedure.<sup>19</sup>

**Table 2: Comparison of McIndoe procedure.**

Study	No. of cases	Graft take (%)	Complications (%)
Alessandrescu et al 1996 <sup>9</sup>	201	96	Rectal perforation (1)
			Graft infection (4)
			Donor infection (5.5)
Seccia et al 2002 <sup>10</sup>	32	90.6	Graft partial take (9.4)
			Anxiety (6.3)
			Donor site keloids (3.1)
Cali et al 1968 <sup>15</sup>	113	-	Contracture (42)
Ortiz-Monasterio 1972 <sup>16</sup>	21	-	Contracture (19)
Buss et al 1989 <sup>14</sup>	50	-	Revision procedure (10)
			Contracture (15)
Present study 2007	7	100	Contracture (14.3)

10 patients (41.6%) underwent Neurovascular pudendal thigh flap surgery. Flaps were posteriorly based in 9 patients and anteriorly based in 1 patient. An anatomical study of 20 sides in 10 cadavers was done. The flap has multiple blood supplies. The middle portion of the flap is supplied by anterior cutaneous branches of obturator artery. The lateral branches of posterior labial arteries supply the major portion of the flap.<sup>20</sup> Our study was

compared with other studies in Table 3. The operating time was between 120 to 150 minutes same as Wee et al study.<sup>21</sup> The mean vaginal depth obtained was 8 cm and width was 2 cm. A flap of size was 14x5 cm demonstrated by Li et al.<sup>22,23</sup> Hair growth in our series of was not noticeable, but other studies have shown obvious appearance.<sup>24,25</sup> 1 patient had menarche 3 months after surgery. Restoration of uterovaginal continuity is possible with flap procedures.<sup>26</sup>



**Table 3: Comparison of pudendal thigh flap procedure.**

Study	No of cases	Flap survival (%)	Complications (%)
Wee et al 1989 <sup>21</sup>	3	100	Nil
Li et al 2000 <sup>22</sup>	12	91.6	Total flap necrosis (8.3)
Chen et al 1991 <sup>29</sup>	4	100	Nil
Gurlek 2002 <sup>30</sup>	31	100	Wound dehiscence (6.4)
Li et al 2003 <sup>31</sup>	47	100	Nil
Selvaggi et al 2003 <sup>26</sup>	2	100	Granulomatous polyp (50) Stenosis (50)
Sanchez et al 2006 <sup>32</sup>	33	100	Hematometra (9) Wound dehiscence (10)
Present study 2007	10	100	Hematometra (10) Pelvic abscess (10)

2 patients (8.3%) underwent horse shoe shaped labia minora flaps. Purushothaman has advised the use of dilator for 3 months post operatively for satisfactory vaginal depth.<sup>27</sup> Flack et al had vaginal depths of size 7, 5

and 7 cm in three patients immediately after surgery and achieved 10, 9 and 7 cm after dilation.<sup>28</sup> Because of smaller size of flaps Hwang et al suggested additional use of split skin graft with labia minora flaps.<sup>18</sup> These results were compared with other studies in Table 4.

**Table 4: Comparison of horse shoe flap procedure.**

Study	No. of cases	Flap survival (%)	Complications (%)
Purushothaman 2005 <sup>27</sup>	15	100	Nil
Hwang et al 1985 <sup>18</sup>	10	100	Additional SSG (30)
Flack et al 1993 <sup>28</sup>	3	100	Nil
Present study 2007	2	100	Stenosis (50)

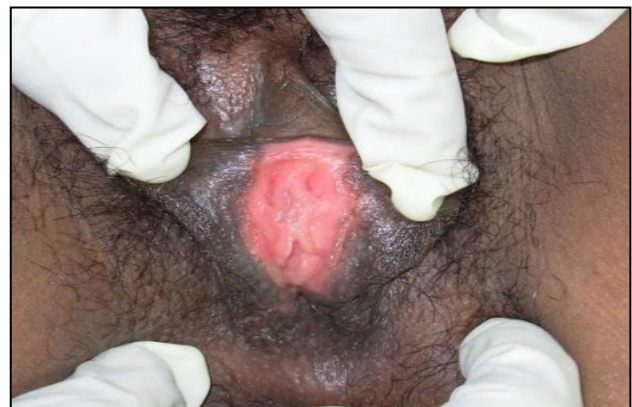
**Table 5: Comparison of our surgical procedures.**

Observation	McIndoe (7)	Pudendal (10)	Horse shoe (2)
Operating time (minutes)	75 to 120	120 to 150	150 to 180
Mean vaginal depth (cm)	UM-7,M-8	8	UM-8,M-6
Cosmetic appearance	Good	Fair	Fair
Complications	Contracture-1	Wound dehiscence-1 Hematometra -1 Pelvic abscess-1	Stenosis- 1

The results of three surgical procedures in our study were compared with each other in Table 5. The operating time is least for McIndoe procedure because of simplicity and longer for horse shoe flaps because of difficulty in dissection.

The mean vaginal depth was 7 cm for unmarried and 8 cm for married patients who underwent McIndoe procedure. The mean vaginal depth was 8 cm for patients who underwent pudendal thigh flaps. The vaginal depths were 8cm and 6 cm for patients who underwent labia minora flaps. A survey of text books and medical papers in the mid-1990's revealed average quoted lengths ranging from 9 to 11cm for the longest (posterior) wall in normal XX women. Shah and Woolley gave the normal length as greater than or equal to 6 cm. In our study satisfactory vaginal length was achieved. The vaginal depth tends to decrease over time in unmarried group especially when the patient was irregular in using vaginal stent.

Cosmetic appearance was good in patients who underwent McIndoe procedure as the genitalia were not distorted (Figure 1).



**Figure 1: Abbe McIndoe skin graft- good cosmetic appearance.**



**Figure 2: Pudendal flaps- fair cosmetic appearance with donor scars.**

Donor area scar was acceptable or skin graft can be taken from hidden regions. Cosmetic appearance was fair in patients who underwent pudendal thigh flaps because the donor area scars and flap's skin colour were noticeable (Figure 2). Cosmetic appearance was fair in patients who underwent horse shoe flap procedure because the external genitalia were distorted (Figure 3).



**Figure 3: Horse shoe flap- fair cosmetic appearance.**

Contracture rate was more in patients who underwent McIndoe procedure especially who were irregular in using stents. No other significant complications occur with this procedure. For well executed pudendal thigh flaps complications were very minimal. Horse shoe flaps are technically difficult to execute and also the depth obtained was not satisfactory. Contracture rate was very high as well as patients need to be well motivated for post-operative dilatation programme.

## CONCLUSION

Indian patients present little later than the western world and a considerable number of patients present late even after marriage. Non acceptance for surgical procedure is high (20.8%) even after counselling. The Abbe McIndoe procedure was simple, safe procedure with good aesthetic

results and had least complication rate. The Neurovascular pudendal thigh flap procedure was simple, safe procedure with fair aesthetic results and had acceptable complication rate. The Horse shoe flap procedure was technically difficult procedure with fair aesthetic results and had high contraction rate. Flap procedure is the preferable as most of our patients were very irregular in follow up and stent usage. A Neurovascular pudendal thigh flap which has the least contraction rate is a better treatment option for such patients.

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## REFERENCES

1. Fliegner JR. Congenital atresia of the vagina. Surg Gynecol Obstet. 1987;165(5):387-91.
2. Evans TN, Poland ML, Boving RL. Vaginal malformations. Am J Obstet Gynecol. 1981;141(8):910-20.
3. Jones KL. Noonan syndrome (Turner-like syndrome). In: Smith's recognizable patterns of Human malformation 4th ed. Philadelphia WB Saunders; 1988:122-123.
4. Tarry WF, Duckett JW, Stephens FD. The Mayer-Rokitansky syndrome: pathogenesis, classification and management. J Urol. 1986;136(3):648-52.
5. Rock JA, Breech LL. Surgery for anomalies of the mullerian ducts. In: Rock JA, Jones III HW, eds. TeLinde's Operative Gynecology. 50th ed. New York Lippincott-Raven; 1997:687-729.
6. Prabhakar U. A Study on Reconstructive Options for Vaginal Agenesis (Doctoral dissertation, Madras Medical College, Chennai). 2007.
7. Ingram JM. The bicycle seat stool in the treatment of vaginal agenesis and stenosis: a preliminary report. Am J Obstet Gynecol. 1981;140(8):867-73.
8. Roberts CP, Haber MJ, Rock JA. Vaginal creation for müllerian agenesis. Am J Obstet Gynecol. 2001;185(6):1349-53.
9. Alessandrescu D, Peltecu GC, Buhimschi CS, Buhimschi IA. Neocolpopoiesis with split-thickness skin graft as a surgical treatment of vaginal agenesis: retrospective review of 201 cases. Am J Obstet Gynecol. 1996;175(1):131-8.
10. Seccia A, Salgarello M, Sturla M, Loreti A, Latorre S, Farallo E. Neovaginal reconstruction with the modified McIndoe technique: a review of 32 cases. Ann Plast Surg. 2002;49(4):379-84.

11. McIndoe A. Treatment of congenital absence and obliterative conditions of vagina. *Br J Plast Surg.* 1950;2:254-67.
12. Counseller VS, Flor FS. Congenital absence of the vagina: further results of treatment and a new technique. *Surg Clin North Am.* 1957;37(4):1107-18.
13. Strickland JL, Cameron WJ, Krantz KE. Long-term satisfaction of adults undergoing McIndoe vaginoplasty as adolescents. *Adolesc Pediatr Gynecol.* 1993;6(3):135-7.
14. Buss JG, Lee RA. McIndoe procedure for vaginal agenesis: results and complications. *Mayo Clin Proceed.* 1989;64:758-61.
15. Cali RW, Pratt JH. Congenital absence of the vagina: long-term results of vaginal reconstruction in 175 cases. *Am J Obstet Gynecol.* 1968;100(6):752-63.
16. Ortiz-Monasterio F, Serrano A, Barrera G, Araico J. Congenital absence of the vagina: long-term follow-up in 21 patients treated with skin grafts. *Plast Reconstr Surg.* 1972;49(2):165-70.
17. Rock JA, Reeves LA, Retto H, Baramki TA, Zacur HA, Jones HW. Success following vaginal creation for Müllerian agenesis. *Fertil Steril.* 1983;39(6):809-13.
18. Hwang WY, Chang TS, Sun P, Chung TH. Vaginal reconstruction using labia minora flaps in congenital total absence. *Ann Plast Surg.* 1985;15(6):534-7.
19. Feroze RM, Dewhurst CJ, Welply G. Vaginoplasty at the Chelsea hospital for women: a comparison of two techniques. *BJOG Int J Obstet Gynaecol.* 1975;82(7):536-40.
20. Liu Y, Li S, Li Y. Applied anatomic study of the pudendal-thigh flap and establishment of flap model. *Zhonghua zheng xing wai ke za zhi= Zhonghua zhengxing waikexue zazhi= Chinese J Plast Surg.* 2001;17(5):272-5.
21. Wee JT, Joseph VT. A new technique of vaginal reconstruction using neurovascular pudendal-thigh flaps: a preliminary report. *Plast Reconstr Surg.* 1989;83(4):701-9.
22. Li S, Liu Y, Li Y. Twelve cases of vaginal reconstruction using neurovascular pudendal-thigh flaps. *Zhonghua Fu Chan Ke Za Zhi.* 2000;35(4):216-8.
23. Khazanchi RK, Takkar D. Vaginal depth following reconstruction with pudendal thigh flaps in congenital vaginal atresia. *Plast Reconstr Surg.* 1997;99(2):592-3.
24. Giraldo F, Solano A, Mora MJ, Smith V. Hair growth in the vagina after reconstruction with pudendal thigh flaps in congenital vaginal agenesis. *Plast Reconstr Surg.* 1998;102(3):924-5.
25. Karacaoglan N. Hair growth in the vagina after reconstruction with pudendal thigh flaps in congenital vaginal agenesis. *Plast Reconstr Surg.* 1997;100(6):1618.
26. Selvaggi G, Monstrey S, Depypere H. Creation of a neovagina with use of a pudendal thigh fasciocutaneous flap and restoration of uterovaginal continuity. *Fertil Steril.* 2003;80(3):607-11.
27. Purushothaman V. Horse shoe flap vaginoplasty- a new technique of vaginal reconstruction with labia minora flaps for primary vaginal agenesis. *Br J Plast Surg.* 2005;58(7):934-9.
28. Flack CE, Barraza MA, Stevens PS. Vaginoplasty: combination therapy using labia minora flaps and Lucite dilators- preliminary report. *J Urol.* 1993;150(2):654-6.
29. Chen Z, Chen C, Chen M, Zhang J, Wu N, Wang J. Vaginal reconstruction using perineal-thigh flaps with subcutaneous pedicle. *Chinese Med Sci J= Chung-Kuo I Hsueh K'o Hsueh Tsa Chih.* 1991;6(1):14-7.
30. Gürlek A. The versatility of the pudendal thigh fasciocutaneous flap used as an island flap. *Plast Reconstr Surg.* 2002;109(1):402-3.
31. Li GZ, Cheng XD, Zhao TL, Xu J, Ge SX, Wang HG, et al. Experience of vaginal reconstruction by using a pudendal-thigh island flaps. *Zhonghua zheng xing wai ke za zhi= Zhonghua zhengxing waikexue zazhi= Chinese J Plast Surg.* 2003;19(3):183-5.
32. Contreras JS, Romero IP, Mancera JC, Vivar LEH. Surgical correction of vaginal agenesis. *Ginecol Obstet Mex.* 2006;74(01):37-47.

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