Pudendal-Thigh Flap Vaginoplasty in the Reconstruction of Genital Anomalies

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VAGINAL RECONSTRUCTION is indicated in children with ambiguous genitalia associated with disorders of sexual differentiation and in cloacal abnormalities. The principles of surgical management include early sex assignment and genital reconstruction planned in conjunction with correction of urinary and bowel malformations. Although the aim of vaginoplasty is to create a neovagina that is both cosmetically and functionally satisfactory using the simplest available technique, the wide variation in the complexity of genital abnormalities has resulted in the development of numerous procedures using skin grafts, flaps, and isolated intestinal segments, all of which have several disadvantages. In 1989 Wee and Joseph introduced the use of the bilateral pudendal-thigh flaps for total vaginal reconstruction. The flap derives its blood supply from the posterior labial and perineal artery, which branches off from the pudendal artery. It retains its innervation from the posterior labial branches of the prineal nerve, which arises from the pudendal nerve. This report is a review of experience in the use of the technique in children with genital abnormalities.

MATERIALS AND METHODS

Over a 9-year period 12 patients ranging in age from 6 months to 14 years underwent vaginal reconstruction using the pudendal-thigh flap technique (Table 1). Six cases had genital abnormalities (CAH) diagnosed in the neonatal period. They were treated medically with corticosteroid replacement therapy and were referred for surgery primarily because of the markedly enlarged clitoris. Investigations showed the presence of urogenital sinus with proximal insertion of the vagina. Reconstruction rather than simple perineal correction of the abnormality was deemed necessary. In four patients, clitoral reduction was performed in infancy, and vaginoplasty using the pudendal-thigh flap technique was subsequently carried out between the ages of 3 to 7 years. There was an earlier attempt, in two of these four patients, at repair of the urogenital sinus through a perineal pull-through procedure with turning in of posterior and lateral flaps. In both cases the reconstruction failed and the vagina retracted with complete closure of its opening. In the other two patients single-stage clitoral reduction with vaginoplasty was performed at 6 and 8 months of age. All six patients with urogenital sinus abnormalities underwent definitive reconstruction with separation of the vagina, closure of the communication with the urethra, and pudendal-thigh flap vaginoplasty.

Three patients with vaginal atresia presented late, two at 11 years and one at 14 years of age. The genital abnormality had not been detected earlier presumably because of failure to examine the perineum closely. All three patients underwent laparotomy after full evaluation. Normal internal female organs with ovaries, tubes, uterus, and proximal vagina were noted in two patients. The third patient was found to have remnants of Mullerian duct structures with no vagina.

There were two patients with cloacal abnormalities who had been treated initially with sigmoid colostomy, followed 1 year later by combined abdominal and posterior sagittal exploration. Reconstruction of the bowel and urethra was carried out, but the vaginoplasty failed resulting in urethrovaginal fistula in one case. In these two patients a combined abdominoperineal exploration was carried out to identify and close the fistula and to define the proximal margin of the vagina. Posterior sagittal reexploration was not necessary because in both cases the proximal structures could not be identified and dissected sufficiently to establish a cuff of vagina for anastomosis to the flaps. The patient with testicular feminizing syndrome was thought to have scrotal hypospadias at birth. However, after full investigation, the parents consented to raising the infant as a female, and vaginoplasty with removal of the male gonads was carried out at the age of 6 years.

Surgical Technique

Details of the operation have been described previously and are illustrated in Fig 1. The key steps are the dissection of the space for the neovagina and the elevation of the flaps on the adductor muscle to...
Table 1. Clinical Conditions and Results of Treatment in Genital Abnormalities

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of Cases</th>
<th>Primary Treatment</th>
<th>Outcome</th>
<th>Secondary Correction</th>
<th>Final Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAH</td>
<td>2</td>
<td>Clitoral reduction, perineal repair of U-G sinus</td>
<td>Failed with vaginal retraction and stenosis</td>
<td>Reoperative with PFV</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>CAH</td>
<td>2</td>
<td>Clitoral reduction</td>
<td>U-G sinus uncorrected</td>
<td>Correction of U-G sinus with PFV</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>CAH</td>
<td>2</td>
<td>Clitoral reduction, primary PFV</td>
<td>Primary healing</td>
<td>—</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Vaginal atresia</td>
<td>3</td>
<td>Laparotomy, PFV</td>
<td>Primary healing</td>
<td>—</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Cloaca</td>
<td>2</td>
<td>Posterior sagittal, abdominal repair</td>
<td>Vagina uncorrected, urethrovaginal fistula (1 case)</td>
<td>Abdomino-perineal exploration with PFV</td>
<td>Adequate opening of bowel, urethra and vagina. Fecal incontinence</td>
</tr>
<tr>
<td>Testicular feminizing syndrome</td>
<td>1</td>
<td>Laparotomy, gonadectomy, PFV</td>
<td>Primary healing</td>
<td>—</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>

Abbreviations: CAH, congenital adrenal hyperplasia; PFV, pudendal-thigh flap vaginoplasty; U-G sinus, urogenital sinus.

RESULTS

All patients recovered satisfactorily from surgery and have been followed-up for a mean of 5.7 years. Three patients have ceased follow-up and one patient attends.
irregularly because she has settled abroad. There were no instances of flap loss and only two patients had minor superficial necrosis at the tip, which healed spontaneously. Four patients with adrenogenital syndrome and three with vaginal atresia have passed puberty. They exhibit secondary sex characteristics and report having regular menstruation. The patient with testicular feminizing syndrome has been maintained on estrogens to retain her female habitus, but she has become grossly obese. The two patients with cloacal abnormality have a rather flat-looking perineum. Although they are able to void without catheterization, their bowel function has not been satisfactory, and they are currently being managed with a regime of daily enemas with dietary control. The results on follow-up of patients with the pudendal-thigh flap reconstruction indicate that the neovagina has remained supple and adequate in size without the need for dilatation (Fig 2). Although sensation has been noted to be present it is not yet possible to assess sexual function.

**DISCUSSION**

Patients with ambiguous genitalia present with a spectrum of disorders that require varying degrees of surgical intervention. All cases require thorough preoperative evaluation not only of the genital abnormality but also of the urinary tract and bowel. In the simplest cases the defect can be corrected with a perineal procedure using local flaps derived from the clitoral fold or from adjacent labial skin. In more severe cases the proximal vagina needs to be mobilized to allow it to reach the perineal tissues for anastomosis. Although relatively easy to apply, the procedure often results in complications, especially stenosis of the vaginal orifice, and prolonged follow-up treatment may be required. Major deformities in which the vagina is either inadequately developed or absent require reconstruction with other tissues to achieve a long-term satisfactory result. The procedures that have been used include skin grafts, skin flaps, myocutaneous flaps, free flaps and intestinal segments. Vaginoplasty using bowel has proved to be a versatile technique because it can be applied to the correction of a wide variety of abnormalities. Although all these procedures have been successfully used, there are many disadvantages, including the need for stenting and dilatation as well as problems with leucorrhoea, incorrect angle, lack of innervation, long thigh scars, and unreliable blood supply leading to flap necrosis.

The pudendal-thigh flap has the advantages of being simple and reliable with robust tissue that can be used to create a neovagina with a natural angle and with sensation. It can be easily applied in single-stage reconstruction of genital deformities. Alternatively, it can also be carried out at a later stage when urethral reconstruction has been completed. The well-vascularized bulk of tissue that constitutes the flap provides a good support to the urethral suture line and fills in the dead spaces completely. In cloacal abnormalities it is a useful method of creating a vaginal tube of good length to reach from the proximal vagina to the perineum without difficulty. Complications in the surgical treatment of the cloaca are often associated with technical difficulties in the reconstruction of the vagina. Full preoperative evaluation, selection of the most appropriate surgical approach, and awareness of the large number of anatomic variations are essential for successful treatment. Vaginal agenesis, which may be an isolated defect or associated with the syndrome of aplasia of the Müllerian ducts, has been treated by a variety methods including pressure dilatation of the vaginal pit, local flaps, and interposition of bowel segments. The three patients in this series were all treated with pudendal-thigh flap vaginoplasty with satisfactory results.

Over the past decades concepts in the management of patients with genital abnormalities have undergone significant changes. Multi-staged operations have been replaced by single-stage procedures with the aim of total correction of the anatomic deformity and restoration of function. The pudendal-thigh flap vaginoplasty has proved to be a simple and reliable technique that can be readily adapted to a variety of situations in genital reconstruction. The external appearance of the vagina is satisfactory, though some minor prolapse of the base of the flaps at the level of the introitus may occur, which can be improved by trimming. The technique has been modified for use in adult patients with oncologic disease by

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**Fig 2.** Digital examination of neovagina showing adequate capacity and depth.
dividing the labia posteriorly and insetting the flaps in the space behind, thus avoiding the need to tunnel beneath this structure. The pudendal-thigh flap can also be used to replace tissue that has been lost after previous failed attempts at vaginal reconstruction. It represents a versatile technique for reconstructive surgery of the genitalia in many congenital anomalies, and has given satisfactory results.

REFERENCES