

ORIGINAL RESEARCH

Vaginoplasty in Male-to-Female Transsexual Surgery: A Training Concept Incorporating Dissection Room Experience to Optimize Functional and Cosmetic Results

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ABSTRACT

Introduction. Learning a new technique, even for an established surgeon, requires a learning curve; however, in transsexual surgery especially, there is a lack of professional and public tolerance for suboptimal aesthetic and functional results due to a learning curve.

Aims. In this context, we have tried to build a learning concept for vaginoplasty that includes four steps: (i) formal identification of the surgical steps in order to provide both measure of surgical process and measures of outcomes; (ii) training on cadavers with expert assistance; (iii) performing the live surgery with assistance from expert; and (iv) performing the surgery alone. Herein, we emphasize the second step of our learning concept.

Material and Methods. Between September 2013 and December 2013, 15 cadavers were operated on by an established surgeon learning vaginoplasty under assistance from two expert practitioners. Mean global time and mean time necessary to perform each step of the operation were recorded by the experts. Intraoperative complications were systematically registered. The final depth and diameter of the neovaginal cavity were precisely measured. For each cadaver, the aesthetic results were assessed by one of the experts.

Results. Mean total operating time was 179 ± 34 minutes and decreased from 262 minutes for the first training attempt to 141 minutes for the last one. Intraoperative expert correction included modification of the scrotal triangular flap design and change of position of the urethra: This happened during the first training. No lesion of the urethra or of the anus occurred. The two experts judged the outcomes as excellent in seven cases, very good in four cases, good in two cases, and fair in two cases.

Conclusion. Despite the numerous reports on vaginoplasty in the literature, there is a real lack of published information on the learning curve of this operation. We make the hypothesis that introducing a learning concept with assistance from expert practitioners at the beginning of the surgeon's experience can optimize both the duration of his learning curve and reduce the risk of major complications. **Leclère FM, Casoli V, and Weigert R. Vaginoplasty in male-to-female transsexual surgery: A training concept incorporating dissection room experience to optimize functional and cosmetic results. J Sex Med 2015;12:2074–2083.**

Key Words. Vaginoplasty; Male-to-Female Transsexual; Learning Curve; Transsexualism; Sex Reassignment Surgery

Introduction

Vaginoplasty is the main surgical operation in male-to-female transsexual surgery (MTFTS); It involves three main procedures, namely, clitoroplasty, new urethral meatoplasty, and vaginoplasty. The first report of vaginoplasty was in 1930 by Dr. Kurt Warnekros, a gynecologist from Dresden, who operated on male to female Lili Elbe [1]. Subsequently, many vaginoplasties in male-to-female transsexual patients were performed with a penile-scrotal flap or a reversed penile flap, either of which could result in an adequately deep vagina [2]. Large case series were reported by Dr. Burou, a French surgeon practicing at his “Clinique du Parc” in Casablanca [3], Drs. Hage in Holland [4], Dr. Meltzer and Dr. Bowers in the United States [5], Drs. Perovic and Djordjevic from Belgrade [6], Dr. Monstrey in Gent [7], Dr Preecha, Dr. Kunaporn, Dr. Watanyusakul and Dr. Tiewtranon in Thailand [8,9], to name a few.

In our own department, which is one of the biggest centers for MTFTS in France, more than 250 patients were successfully operated on. Learning a new technique, even for an established surgeon, requires a learning curve. Unfortunately, in transsexual surgery especially, there is a lack of professional and public tolerance for suboptimal aesthetic and functional results. As a result, the learning curve phase must be optimized. Despite the numerous reports on vaginoplasty in the literature, there is a real paucity of reports on the learning curve of this operation.

In this context, we have tried to build a learning concept that comprises four steps: (i) formal identification of the surgical steps in order to provide both measure of surgical process and measures of outcomes; (ii) training on cadaver with expert assistance; (iii) performing the live surgery with assistance from an expert; and (iv) performing the surgery alone. In this article, we present a learning curve on fresh cadavers before performing this operation on MTFTS patient. We discuss the need to receive assistance from expert practitioners during the whole learning process. Finally, we present the many advantages but also the limitations of a learning curve on fresh cadavers.

Materials and Methods

Subjects

This study was performed in accordance with the ethical guidelines of the University of Bordeaux and conducted on 15 cadavers (mean 74.9 ± 10.7

years) between September 2013 and December 2013. Individuals with any signs of severe disease or previous surgery on the urologic and gynecologic area were excluded from this study. The anatomical specimens, 15 men, were kept at a temperature of 2°C until their dissections.

Surgical Technique

After shaving, the cadaver was positioned in a dorsal decubitus position with the two legs over two tables to mimic the operative gynecologic position with the two legs in stirrups. The surgical technique included 14 steps as following (Table 1) [10]:

Step one—draping the cadaver: In order to mimic the clinical situation, the cadaver was draped accordingly.

Step two—urethral catheter placement: A 18 Fr. urethral catheter was placed in order to find the urethra during dissection.

Step three—scrotal incision and vaginal cavity formation: The inverse Y-shape scrotal incision is presented in Figure 1. A triangular flap was raised in the anovulvar area in order to ensure easy future introitus (Figure 1). The base of the penis was laterally dissected apart from scrotal fat, which was used to build the labia majora bilaterally. The cavity was created after resection of the bulbocavernosum muscles and dissection with monopolar cautery to the central tendinous point of the perineum (Figure 2), then carefully between prostate and rectum. A finger was regularly inserted into the rectum in order to control the accuracy of the dissection and to confirm absence of perforation. Dissection ended when a depth over 12–14 cm was achieved. At the end of step three, the size of the

Table 1 The 14 steps of our surgical technique for vaginoplasty in male to female transsexual

Steps	Description
1	Draping the patient
2	Urethral catheter placement
3	Scrotal incision and vaginal cavity formation
4	Bilateral orchiectomy
5	Penile skin inversion
6	Dismembering of the urethra from the corpora
7	Formation of the neoclitoris
8	Refinement of the neoclitoris
9	Formation of the neovaginalphallic cylinder
10	Fixation of the neoclitoris
11	Neovaginalphallic cylinder insertion
12	Labia majora contouring and positioning the neoclitoris and urethra
13	Tie-over dressing
14	Compression dressing



Figure 1 The inverse Y-shape scrotal incision (the triangular flap: white asterisk; the anal orifice: white arrow)

bulb of corpus spongiosum was reduced with continuous running monocryl sutures.

Step four—bilateral orchidectomy: The testicles were dissected until the level of the external inguinal ring using a dry gauze. The bilateral orchidectomy was performed with #1 Nylon in order to close the external inguinal ring (Figure 3).

Step five—penile skin inversion: Penile skin was bluntly dissected from the body after circular dissection about 0.5 cm from the sulcus coronaries. The dissection was performed superficial to the albuginea to the base of the penis (Figure 4). This allowed a safe penile inversion from sulcus coronaries to scrotal incision.

Step six—dismembering of the urethra from the corpora (Figure 5): The corpus spongiosum was then separated from the two corpora beginning about 15 cm distal to the base. Dismembering was then continued to the base of the penis.

Step seven—formation of neoclitoris (Figure 6): After clamping the penis at its base, a strip of albuginea, with the penile dorsal neurovascular bundle and a small portion of glans, was prepared. Incisions were made laterally from the

sulcus coronaries to the base of the penis preserving a 2-cm width bandelette of albuginea and the deep vascularization. Glans volume was reduced to match that of a normal size of clitoris. Dissection passed in the two corpora with the scissors until the roots of the corpora.

Step eight—refinement of the neoclitoris: The neoclitoris was folded on itself with 3-0 monocryl (Figure 7).

Step nine—formation of the neovaginalphallic cylinder (Figure 8): The skin was inverted, and the neovaginalphallic cylinder was closed using a 3-0 monocryl continuous running suture.

Step ten—fixation of the neoclitoris: The two corpora stumps were sutured together with 3-0 vicryl. The neoclitoris was then fixed to the two corpora stumps with 3-0 monocryl (Figure 9).

Step eleven—neovaginalphallic cylinder insertion (Figure 10): The neovaginalphallic cylinder was placed in the vaginal space after the triangular flap had been sutured into the neovaginal space.

Step twelve—labia majora contouring and positioning the neoclitoris and urethra: The two labia majora were then formed with the scrotal fat. An incision was made in order to externalise the neoclitoris. After externalisation of the glans-penis, about 30% of its surface was left epithelialized forming the neoclitoris, while the remaining de-epithelialized segment was

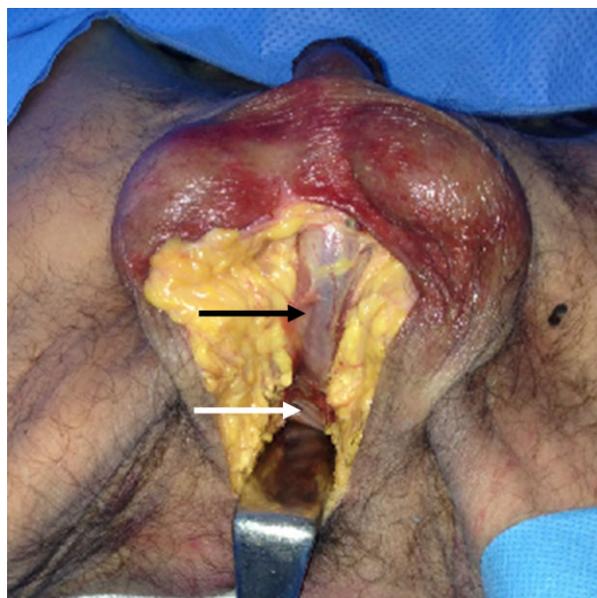


Figure 2 The cavity created after resection of the bulbocavernosum muscles and dissection (the corpus spongiosum: black arrow; the bulbocavernosum muscles: white arrow)

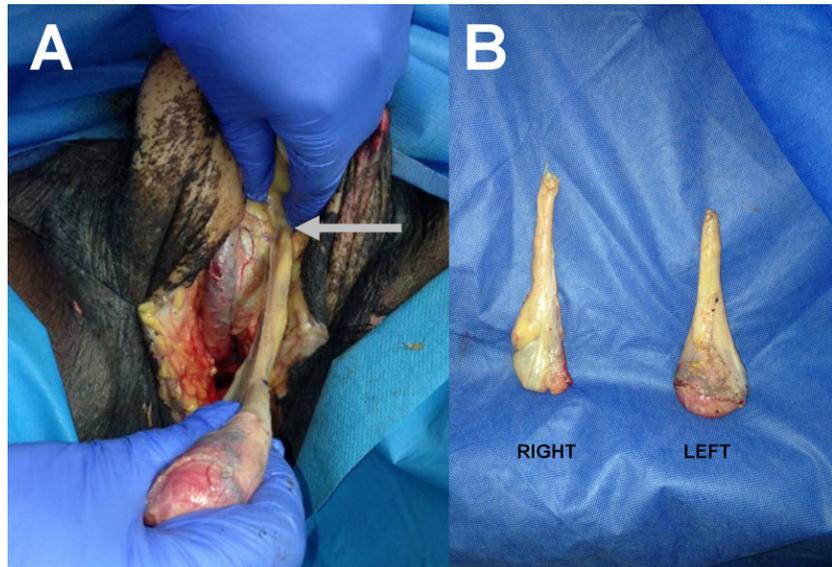


Figure 3 A and B: Bilateral orchiectomy performed with nylon 1 in order to close the external inguinal ring (white arrow)

adapted subcutaneously. The urethra was exteriorised about 1 cm inferior to the neoclitoris. The meatal orifice was implanted with inverted sutures at skin limits after performing two continuous running sutures of the urethral mucosa in order to prevent bleeding. The labia majora was closed in two layers (Figure 11). Step thirteen—tie-over dressing: A tie-over dressing was then performed with Surgicel® (Ethicon, Somerville, NJ, USA) and fixed with #1 Nylon skin suture in order to mimic the clinical situation.

Step fourteen—compression dressing: A compression dressing was then applied to prevent bleeding.

Intraoperative Assessment

Intraoperative correction of the surgical dissection by the experts and intraoperative complications were systematically registered. Total operation time and time necessary to perform each step of the operation were precisely recorded.

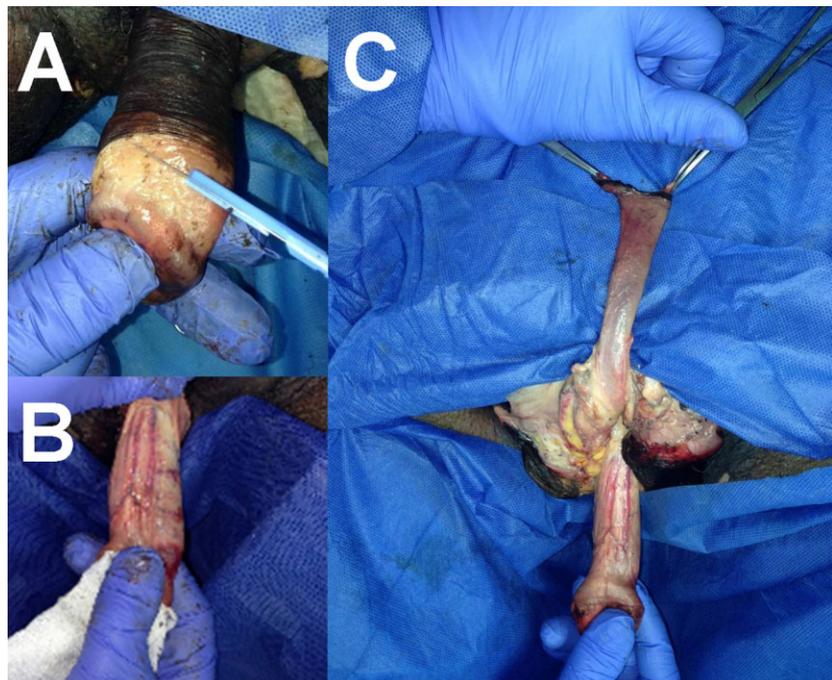


Figure 4 A: Incision for penile skin inversion. B,C: Penile skin inversion

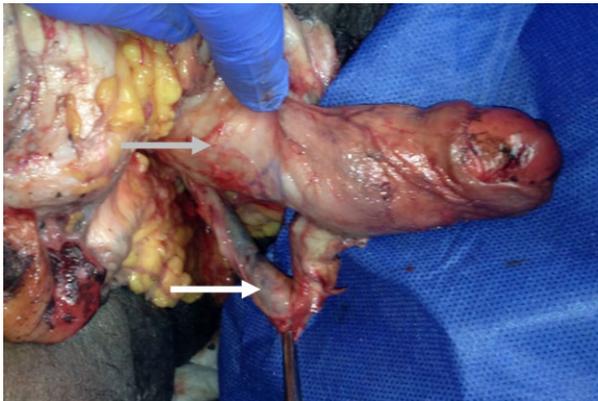


Figure 5 Dismembering of the urethra (white arrow) from the corpora (grey arrow).

Outcomes Assessment

The final depth and diameter of the neovaginal cavity were precisely measured. After each training episode, one of the experts was asked to score the following criteria: size of the neoclitoris (0: bad result/1: good result/2: excellent result), position of

the neoclitoris (0: bad result/1: good result/2: excellent result), position of the urethra (0: bad result/1: good result/2: excellent result), adequacy of the neovaginal cavity (0: bad result/1: fair result/2: good result/3: very good result/4: excellent result), position and tension on the triangular flap (0: bad result/1: good result/2: excellent result), size of the neo labia minora (0: bad result/1: good result/2: excellent result), size of the neo labia majora (0: bad result/1: good result/2: excellent result), symmetry (0: bad result/1: good result/2: excellent result), and ease of insertion (0: bad result/1: good result/2: excellent result). This evaluation results in a score from 1 to 20 as following: 19–20/20: excellent outcome, 17–18/20: very good outcome, 15–16: good outcome, 13–14/20 fair outcome, and <13/20: poor outcome.

Measured Parameters

Data analysis was performed using spss program (SPSS v. 22.0, SPSS Inc., Chicago, IL, USA). Data are presented as mean \pm standard deviation of the mean.

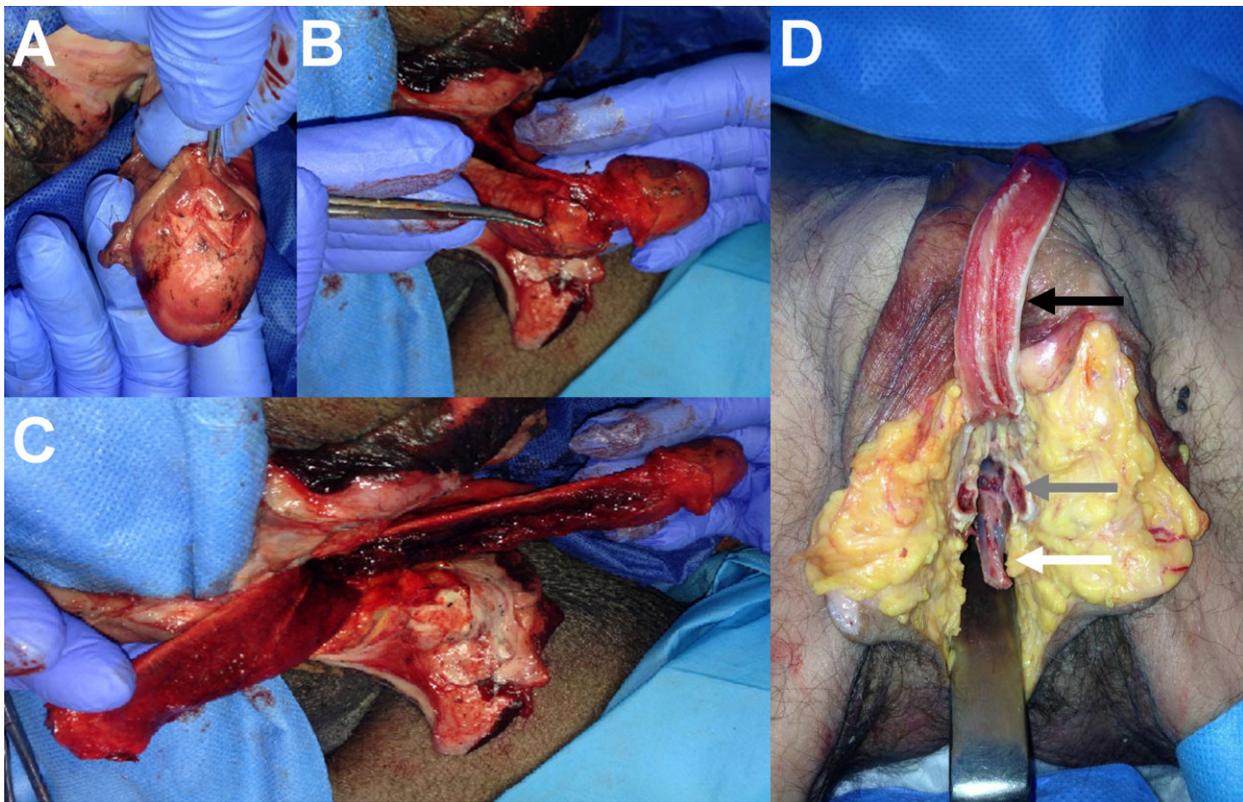


Figure 6 A: Incision for the neoclitoris flap. B and C: Dissection passed in the two corpora with the scissors until the roots of the corpora. D: The neoclitoris flap (black arrow: the neoclitoris flap; grey arrow: the roots of the corpora; white arrow: the urethra)

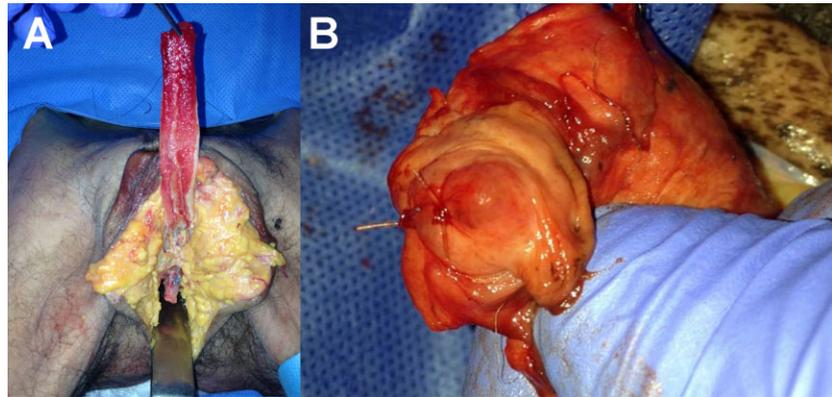


Figure 7 A: The roots of the corpora sutured together. B: The neoclitoris after refinement

Results

Intraoperative Findings

Mean total operating time was 179 ± 34 minutes and decreased from 262 minutes at the first training session to 141 minutes at the last one. Time necessary for each step of the procedure is detailed in Table 2.

Complications During Surgery

Intraoperative expert corrections included modification of the triangular flap design and position of

the urethra: This happened during the first training session. Following the advice of the experts, a running suture was performed in all but one case, in order to reduce the size of the bulb of corpus spongiosum during step three. No lesions of the urethra or of the anus occurred.

Vaginoplasty Outcomes (Figure 11)

The mean length of the neovagina was 13.8 ± 0.7 cm, the mean diameter was 4.8 ± 0.4 cm. The two experts judged the outcomes as excellent in



Figure 8 Formation of the neovaginalphallic cylinder

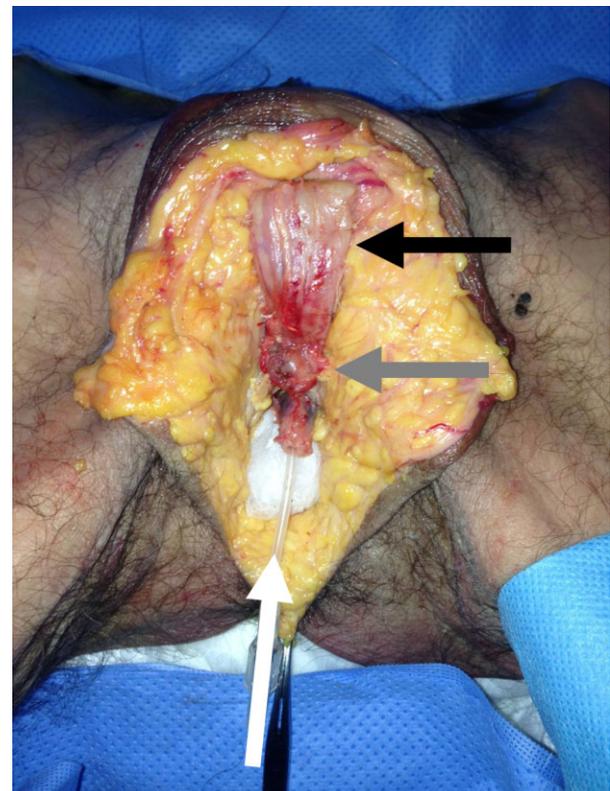


Figure 9 Fixation of the neoclitoris (black arrow: the neoclitoris flap folded on itself; grey arrow: the neoclitoris; white arrow: the triangular flap)

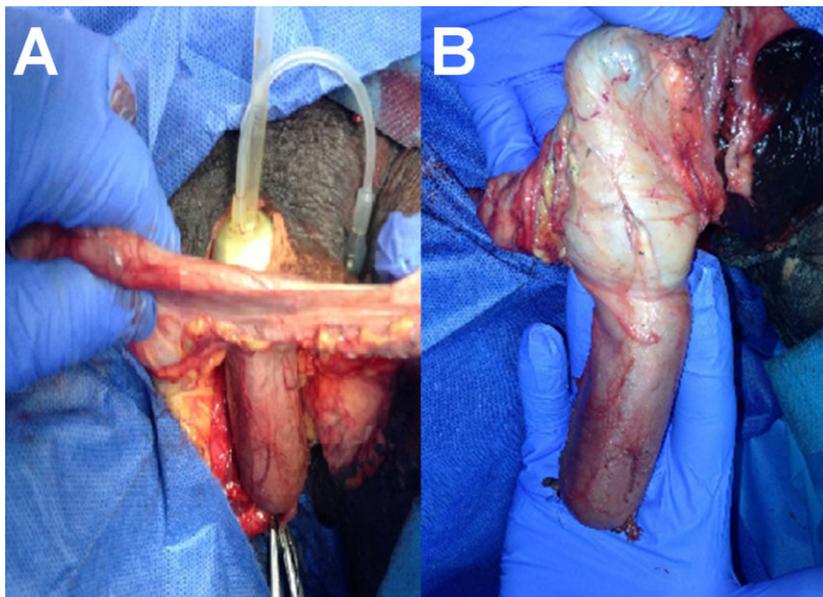


Figure 10 A and B: The neovaginalphallic cylinder is prepared for insertion in the cavity.

seven cases, very good in four cases, good in two cases, and fair in two cases (Table 3).

Discussion

Between September 2013 and December 2013, 15 vaginoplasties were performed on fresh cadavers by an established surgeon learning this new technique under assistance from two experts. Mean total operating time between the first and last training session decreased from 262 minutes to 141 minutes. Intraoperative expert correction included modification of the scrotal triangular flap design and position change of the urethra: This

happened during the first training. No lesion of the urethral or of the anus occurred. The two experts judged the outcomes as excellent in seven cases, very good in four cases, good in two cases, and fair in two cases.

In 1936, TP Wright, an aeronautical engineer, published the first description of a learning curve [11]. His thesis was that speed or efficiency of airplane component production increased, and cost decreased, as the experience and skill of the workforce increased. In industry, measures of efficiency are easy to objectify and include criteria like production time, costs, quality control, etc. However, it is more difficult to assess a surgeon'

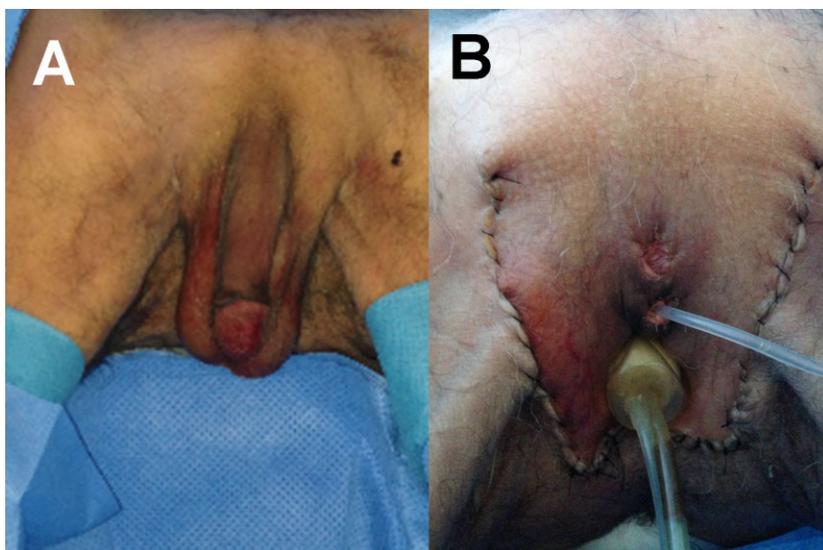


Figure 11 Anatomical subject before (A) and after vaginoplasty (B)

Table 2 Total operating time and time necessary for each step of the procedure

	Step 1 (min)	Step 2 (min)	Step 3 (min)	Step 4 (min)	Step 5 (min)	Step 6 (min)	Step 7 (min)	Step 8 (min)	Step 9 (min)	Step 10 (min)	Step 11 (min)	Step 12 (min)	Step 13 (min)	Step 14 (min)	Tt (min)
1	10'	2'	55'	14'	15'	10'	16'	5'	7'	5'	31'	78'	3'	11'	262'
2	5'	2'	48'	14'	11'	9'	14'	5'	8'	4'	34'	70'	2'	7'	233'
3	4'	1'	47'	11'	13'	8'	15'	6'	4'	4'	18'	71'	2'	7'	211'
4	4'	1'	42'	9'	11'	8'	8'	4'	4'	3'	24'	59'	2'	6'	185'
5	4'	1'	41'	9'	12'	7'	10'	4'	3'	3'	31'	58'	2'	7'	192'
6	4'	1'	47'	8'	9'	8'	7'	5'	3'	3'	14'	55'	2'	7'	173'
7	4'	1'	41'	7'	9'	9'	8'	3'	3'	3'	17'	54'	2'	6'	167'
8	4'	1'	42'	8'	8'	10'	9'	4'	3'	3'	21'	53'	2'	7'	175'
9	4'	1'	38'	9'	9'	6'	10'	2'	3'	3'	31'	59'	2'	6'	183'
10	4'	1'	33'	8'	10'	7'	5'	2'	2'	3'	25'	58'	2'	7'	167'
11	4'	1'	34'	8'	8'	5'	8'	3'	2'	3'	21'	55'	2'	7'	161'
12	4'	1'	37'	9'	9'	5'	7'	2'	2'	3'	18'	51'	2'	5'	155'
13	4'	1'	38'	8'	10'	7'	7'	2'	3'	3'	14'	44'	2'	5'	148'
14	4'	1'	32'	6'	9'	7'	8'	2'	2'	3'	11'	48'	2'	4'	139'
15	3'	1'	35'	7'	8'	5'	7'	2'	3'	3'	10'	50'	2'	5'	141'

TT = total time

performance. Measures of learning related to a surgical technique fall into two categories: measures of surgical process and measures of patient outcomes. Vaginoplasty process measures include operative factors such as operative time, blood loss, and technical adequacy of neovagina formation. Patient outcomes include postoperative factors such as size of the neoclitoris, position of the neoclitoris, position of the urethra, adequacy of the neovaginal cavity, position and tension on the triangular flap, size of the neo labia minora, size of the neo labia majora, symmetry, and ease of intromission.

In transsexual surgery especially, there is a lack of professional and public tolerance for suboptimal aesthetic and functional results [3–9,12–15]. As a result, the learning curve phases must be opti-

mized. In this context, we have tried to build a learning concept [16] that includes four steps: (i) formal identification of the surgical steps in order to provide both measure of surgical process and measures of outcomes; (ii) training on cadavers with expert assistance; (iii) performing the live surgery with assistance from expert; and (iv) performing the surgery alone. In this report, which emphasizes the second step of the learning concept, we could objectively quantify both the surgical process and surgery outcomes. Surgical process was evaluated step by step by the senior authors. All difficulties encountered during the surgical dissection were then discussed accordingly after the training. During the first training session, the position of the triangular flap was changed because it was too close to the anus. A flap

Table 3 Outcomes assessment by two expert practitioners

	SNC/2	NCP/2	UP/2	NVA/4	TF/2	Lm/2	LM/2	Sym/2	EI/2	Total score/20	Results
1	2	2	1	2	2	1	1	1	2	14	F
2	1	1	2	3	2	1	1	1	2	14	F
3	2	2	2	3	2	0	2	2	2	17	VG
4	2	2	2	3	2	1	1	1	2	16	G
5	2	2	1	2	2	2	1	1	2	15	G
6	2	2	2	4	2	2	1	1	2	18	VG
7	2	2	2	3	2	2	2	2	2	19	E
8	2	2	2	4	2	2	2	2	2	20	E
9	2	2	2	4	2	1	2	1	2	18	VG
10	2	2	2	4	2	2	1	2	2	19	E
11	2	2	2	4	2	1	2	2	2	19	E
12	2	2	2	4	2	2	2	1	2	19	E
13	2	2	2	3	2	2	1	1	2	17	VG
14	2	2	2	4	2	1	2	2	2	19	E
15	2	2	2	4	2	2	2	1	2	19	E

SNC = size of the neoclitoris; NCP = position of the neoclitoris; UP = position of the urethra; NVA = adequacy of the neovaginal cavity; TF = position and tension on the triangular flap; Lm = size of the neo labia minora; LM = size of the neo labia majora; Sym = symmetry; EI = ease of intromission; F = fair; VG = very good; G = good; E = excellent

that was too narrow would result in a possible lesion of the anus during dissection or later during intromission. The position of the urethra was also corrected during the same session because a distance of less than 1 cm would lead to possible skin necrosis between urethra and the neoclitoris. Although the measured parameters do not permit a statistical analysis, they show a clear improvement in outcomes during the training. Indeed the debriefing of the expert allowed the trainee to avoid reproducing the same error during subsequent dissections. Another measure of the surgical process was the time necessary to achieve the key steps of the operation. It emphasized the progress made in learning and was also measured in order to stress the operator and put him into the reality of the operating room. Mean total operating time between the first and last training decreased from 262 minutes to 141 minutes. This improvement is not at the expense of the quality of the cosmetic result as demonstrated by the dissection outcomes.

The scores used for assessment of the dissection include the main aesthetic and functional points of vaginoplasty: size of the neoclitoris, position of the neoclitoris, position of the urethra, adequacy of the neovaginal cavity, position and tension on the triangular flap, size of the neo labia minora, size of the neo labia majora, symmetry, and ease of intromission. It stressed the vaginal cavity as one of the most important factors in this operation: adequacy of the neovaginal cavity, position and tension on the triangular flap, and ease of intromission make a total of 8/20. The gradient of the ascent of the learning curve [11,17] for both outcomes and time indicates how quickly the operator's performance improves in this study. This confirmed that introducing a learning concept with assistance from expert practitioners at the beginning of the experience can optimize both the duration of the learning curve and reduce the risk of major complications.

Despite the learning process presented herein, methodological limits remain due to the cadaveric nature of this study. It was not possible to measure operative factors such as time necessary for cauterization and blood loss. Additionally, outcome measures such as viability of the neovaginal cavity, ease of micturition, or clitoris sensitivity could not be assessed.

Conclusion

Despite the numerous reports on vaginoplasty in the literature, there is a real lack of information on

the learning curve of this operation. We make the hypothesis that introducing a learning concept with assistance from expert practitioners at the beginning of the surgeon's experience can optimize both the duration of his learning curve and reduce the risk of major complications.

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Conflict of Interest: The author(s) report no conflicts of interest.

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(a) Drafting the Article

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(b) Revising It for Intellectual Content

Franck Marie Leclère, Vincent Casoli, Romain Weigert

Category 3

(a) Final Approval of the Completed Article

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