Chirurgie de l'Hypospadias

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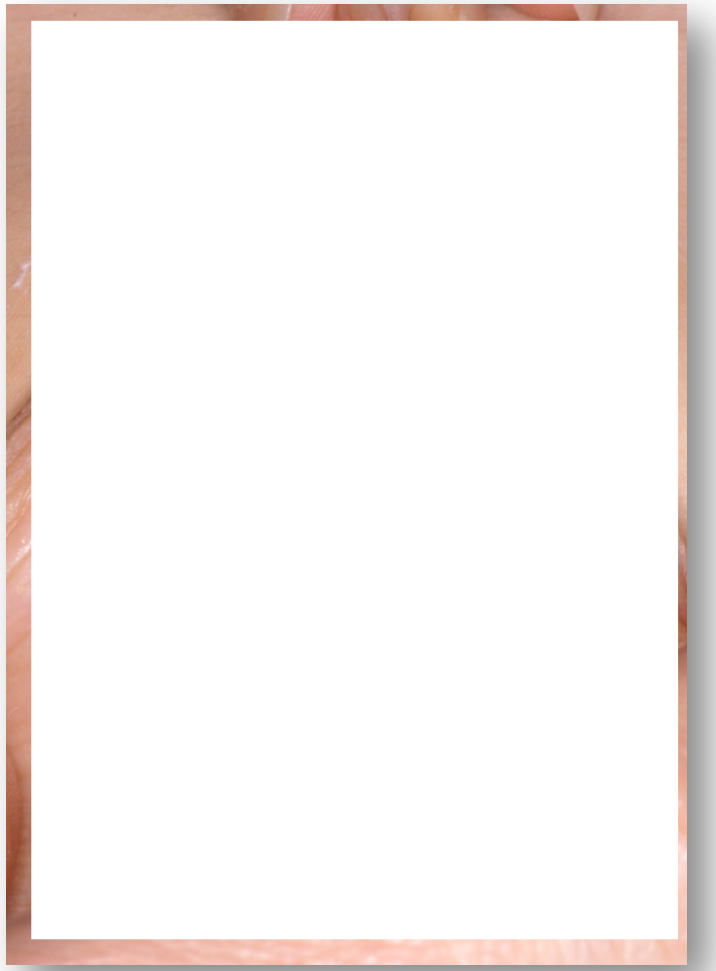
Hypospadias: Une définition

- Arrêt de développement des tissus formant la face ventrale du tubercule génital

J-P Mettauer

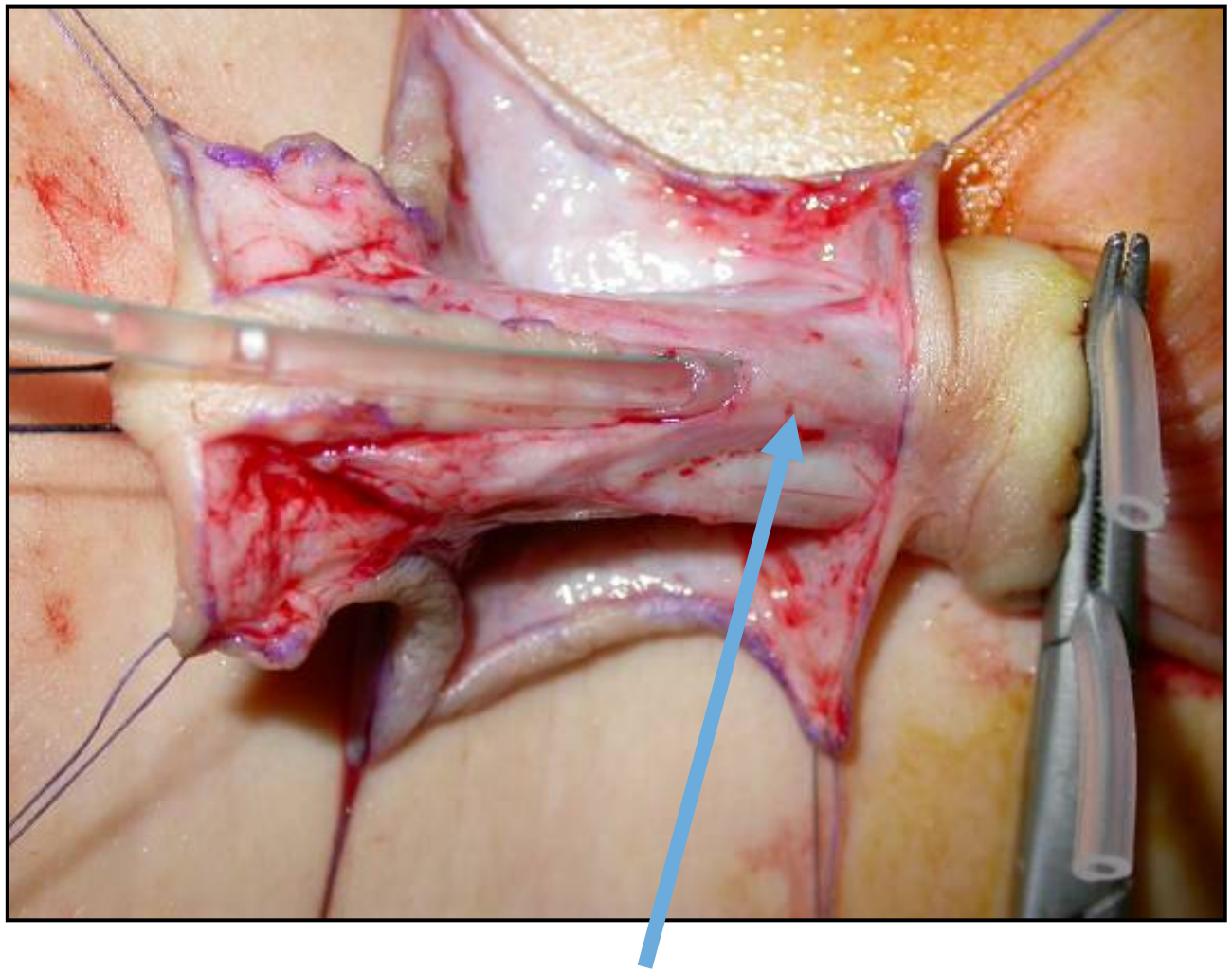
Am J Med Sci 4:43,1842



Trois étapes de la chirurgie de l'hypospade

- 1- **Déshabiller le TG** pour repérer le niveau de division du corps spongieux et évaluer le degré d'hypoplasie des tissus formant la face ventrale du TG
- 2- **Choix de l'uréthroplastie** c-à-d évaluer :
  - La longueur d'urèthre à réparer
  - La largeur et la qualité de la gouttière uréthrale
  - La disponibilité du tissu préputial
  - La courbure du TG après avoir déshabillé la verge
- 3- **La couverture cutanée du TG**

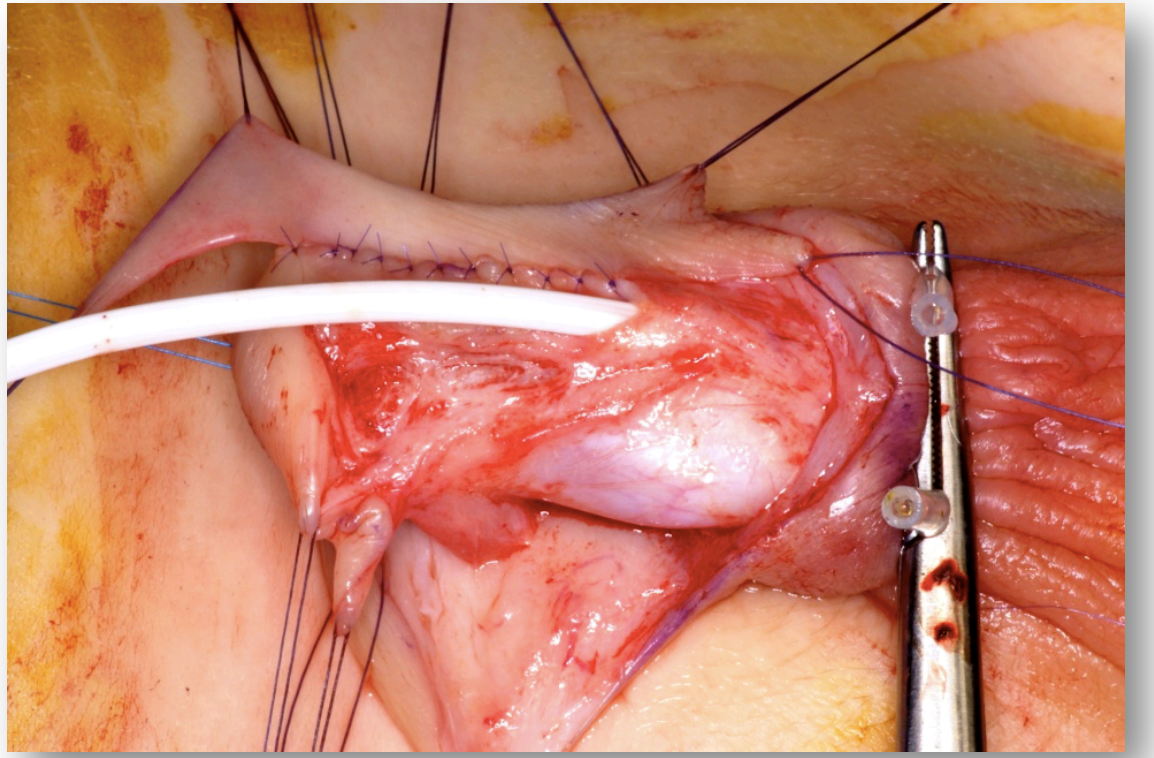
Dissection des faces ventrale et latérales du TG



Etape 1: Identification du niveau de division du corps spongieux

Le choix de l'uréthroplastie

- **Qualité de la gouttière u.**:
  - Large et trophique: Duplay (?)
  - Etroite et trophique:
    - **Uréthroplastie courte**
      - Snodgrass TIP
      - Mathieu
      - Koff
    - **Uréthroplastie longue**
      - Onlay
      - Buccal
  - G.U. pauvre
    - Koyanagi Hayashi
    - Asopa – Duckett tube
    - Uréthroplastie en 2temps (Cloutier Bracka)



Urethroplasties utilisant exclusivement les tissus de la face ventrale du TG

- Thiersch- Duplay
- TIP
- Mathieu

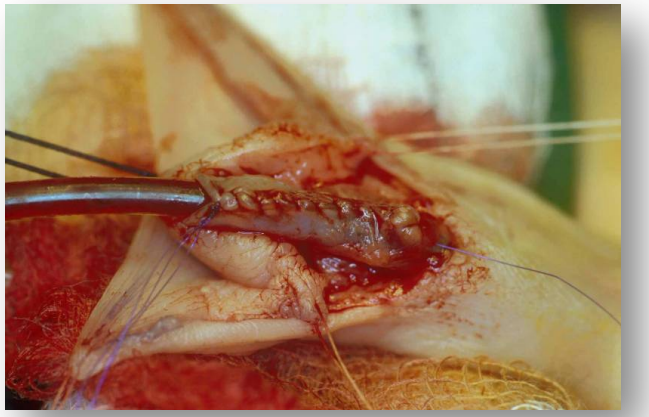
Duplay

- Mode actuelle: Etendre les indications de tubulisation de la GU
  - Facile à apprendre
  - Résultats à court terme satisfaisants
- **Pas de suivi à long-terme publié**
- **Inquiétude sur la croissance des tissus situés en aval de la division du corps spongieux**

Patients & methods

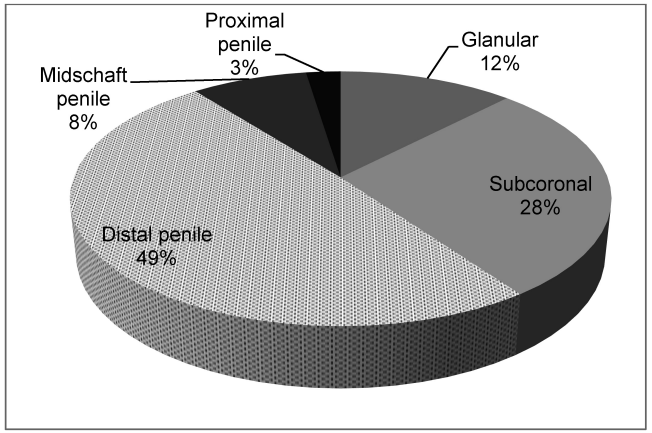
- 600 patients / 22 lost to f-u / 578 complete records
- 1992-2006
- F-U: mean 25.6 months (6 months – 7 years)
- Same technique / same surgeon (HD) / same F-U
- Urethral complications:
  - Fistula
  - Urethral dehiscence
  - Urethral stenosis
  - Clinical dysuria
- Early complications: < 1 year
- Late complications: > 1 year

Thiersch



Results

- Distal hypospadias: 517/578 = 90%
- Mean age at surgery: 28 months (4-199 mo)
- Most patients operated upon between 12 and 24 m
- 360 had foreskin reconstruction



- Of 578: 153 (26.5%) had unsatisfactory outcome
- Of these: 118 had urethral complications (20.4%)

Urethral complications

- Total 118:
  - 97 early (< 1 year) = 57%
  - 73 late (> 1 year) = 43%

- Of 297 patients followed more than 1 year post-operatively
  - 195 free of complications
  - 92 **urethral complications**
    - 58 **< 1 year**
    - 34 **> 1 year**

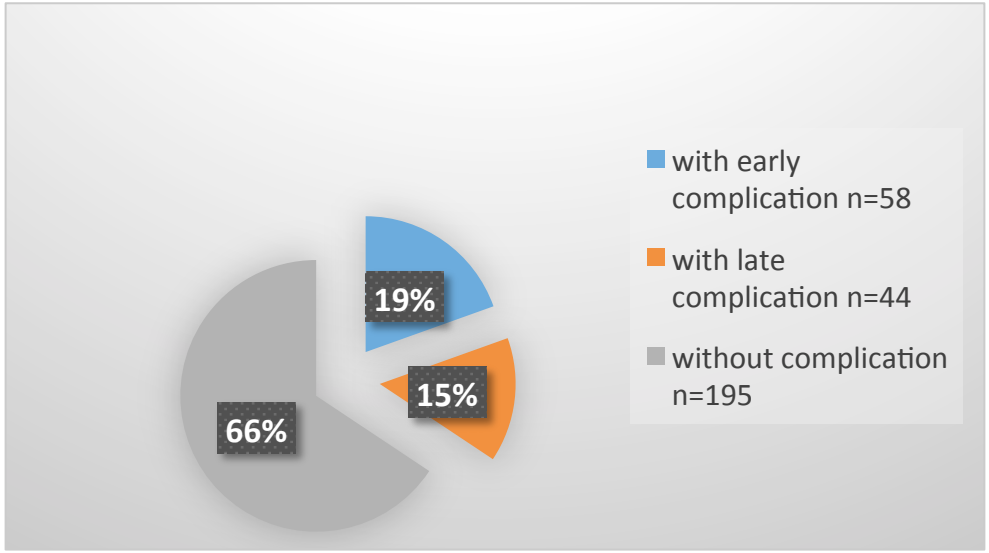
63%

Mostly fistulae

37%

47%

Mostly stenosis



		Distal hypospadias		Mid-shaft hypospadias		Proximal hypospadias		total	
Urethral complications		**90**	**17.4%**	**15**	**31.9%**	**13**	**92.9%**	**118**	**20.4%**
fistula	**total**	**47**	**9.1%**	**10**	**21.3%**	**7**	**50%**	**64**	**11.1%**
	early	38	7.4%	7	14.9%	7	50%	**52**	9%
	late	9	1.7%	3	6.4%	0	0%	**12**	2,1%
Urethral stenosis of the reconstructed urethra	**total**	**44**	**8.5%**	**9**	**19.1%**	**6**	**42.9%**	**59**	**10.2%**
	early	20	3.9%	4	8.5%	2	14.3%	**26**	4.5%
	late	24	4.6%	5	10.6%	4	28.6%	**33**	5.7%
Dehiscence	**total**	**16**	**3.2%**	**2**	**4.3%**	**3**	**21.4%**	**21**	**3.5%**
	early	13	2.6%	0	0%	3	214%	**16**	2.7%
	late	3	0.6%	2	4.3%	0	0%	**5**	0.8%
Urethrocele	**total**	**3**	**0.6%**	**3**	**6.4%**	**1**	**7.1%**	**7**	**1.2%**
	early	1	0.2%	2	4.3%	0	0%	**3**	0.5%
	late	2	0.4%	1	2.1%	1	7.1%	**4**	0.7%
dysuria	**total**	**15**	**2.9%**	**3**	**6.4%**	**1**	**7.1%**	**19**	**3.3%**

Clearly under estimated

Limites des publications sur l'Hypospade

- Etudes le plus souvent **rétrospectives**
- **Pas de consensus sur l'évaluation post-opératoire** des chirurgies de l'H.
  - **Quelle est la valeur des débitmétries?**
    - Les courbes plates sont souvent retrouvées même en l'absence de sténose
      - Parce que les tissus formant l'urèthre reconstruit n'ont pas la même compliance que les tissus uréthraux.
      - Dyssynergie vésico-sphinctérienne habituelle après chirurgie de l'H.: Appréhension à uriner / Mictions contrariées.
  - **Subjectivité de l'observation des mictions**
  - Capacité remarquable de l'enfant à **s'adapter à la dysurie**.

Limites et insuffisances des publications sur le Duplay

- **Peu de publications sur le long-terme**
- Amukele: 265 patients with a f-u of 48 months
  - 11% stricture
- Acimi: 113 patients with a f-u of 84 months
  - 8% fistula / 7% stenosis
  - Date of the diagnosis of complication: not mention

- **Suivi court du TIP**

Resultats Duplay - Snodgrass

- Distal repair: Fistulae: 2%
- Glans dehiscence: 3%
- General review of literature (2035 pts): 9%
  - 5% fistulae
  - 3% metal stenosis
  - 9% dehiscence
  - 2% stricture
- Proximal Snodgrass: 21% fistulae
- Redo Snodgrass: 25% complications
- Snodgraft (buccal inlay graft)

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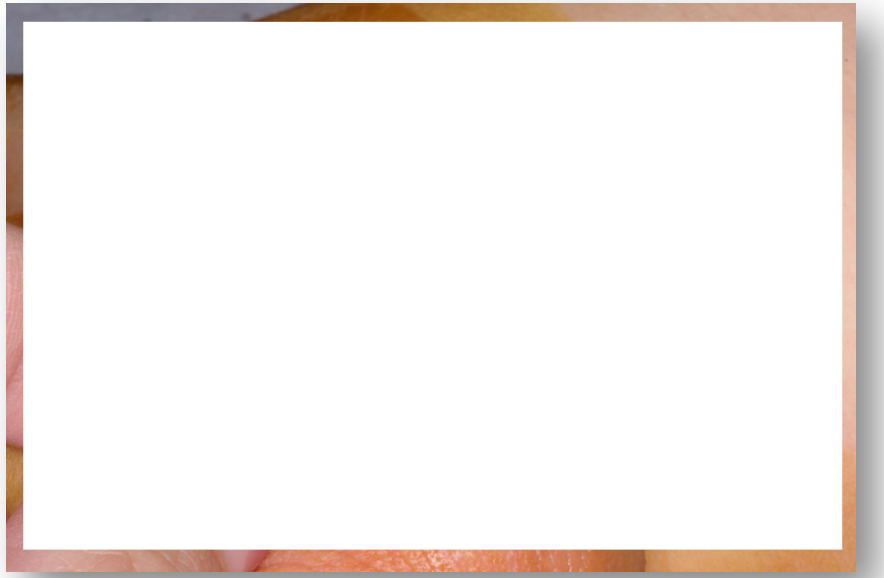
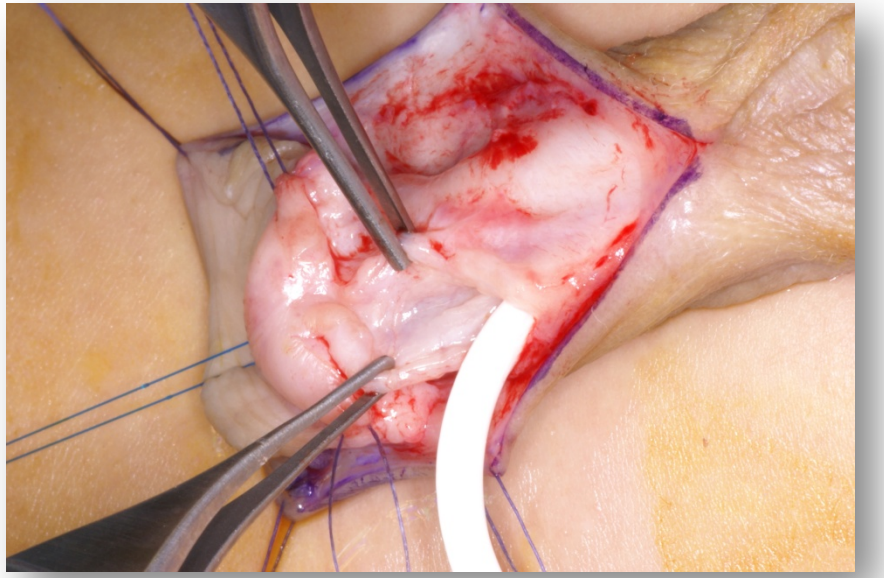
Short Follow-up

Inadéquation uréthrale tardive

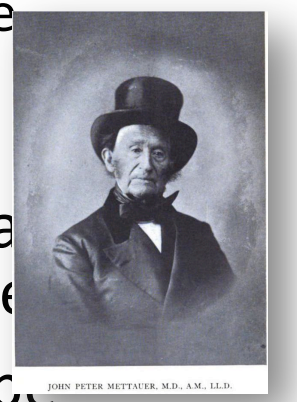
- Résultats à court terme satisfaisants
- Aggravation progressive de la courbure + dysurie





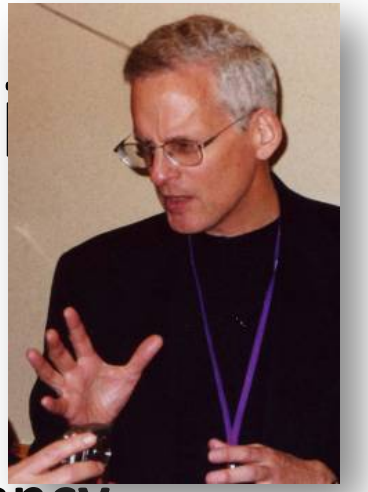
Pourquoi ?

- **Les tissus situés en aval de la division du CS ne grandissent pas à la même vitesse que le reste du TG**
  - Koff's paper in 1999: Tissues located beyond the urethral meatus are less responsive to hormonal stimulation compared to tissues sitting proximal to the division of the spongiosum or dorsal tissues.
  - Protein balance and growth factors are different between the ventrum and the dorsum of the hypospadiac GT


JOHN PETER METTAUER, M.D., A.M., LL.D.

- This reinforces **John Peter Mettauer**'s definition of Hypospadias: It is a « development arrest » of the tissues forming the ventral aspect of the
- Repair of the missing urethra with ventral dysplastic tissues needs to be challenged.

How do ventral tissues grow in hypospadi



- Koff SA, Jayanthi VR.

Preoperative treatment with human chorionic gonadotropin in infancy decreases the severity of proximal hypospadias and chordee.

J Urol. 1999 Oct;162(4):1435-9.

"**Most of the increase in length was proximal to the urethral meatus**, which moved the meatus distally an average of 11.4 mm. (range 6.0 to 19.0), producing a mean increase of 586% in the distance between the penoscrotal junction and meatus. In contrast, **there was no statistically significant increase in penile shaft length distal to the urethral meatus.**"

RESULTS

PROTEINS

VENTRUM

HIGH GELATINASE ACTIVITY
MMP2

LOW CELL JUNCTION PROTEINS
Cadherin E / Claudin 1

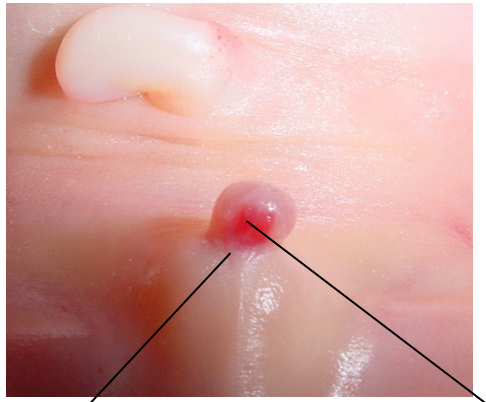
DORSUM
+ CONTROLS

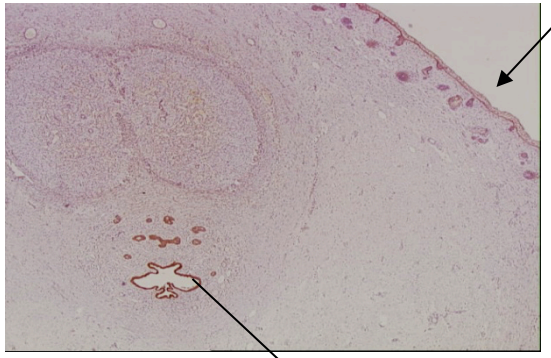
LOW MMP2

NORMAL CELL JUNCTION PROTEINS

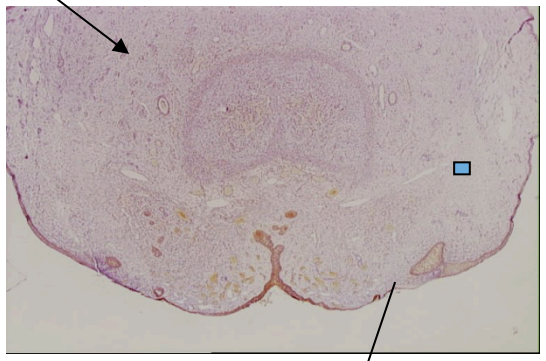
22 week fetus - Hypospadias

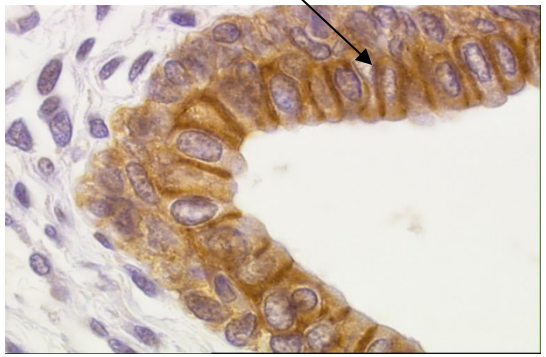
E-Cadherin



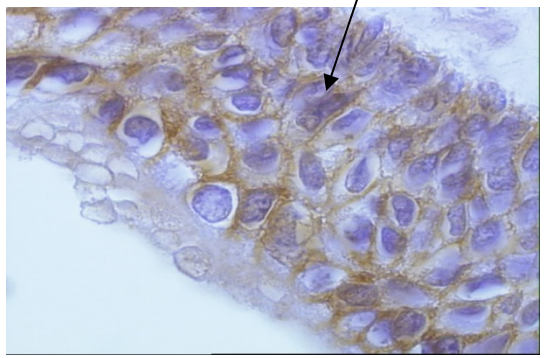


x25





x1000



Notre approche actuelle

- **Beck / Koff** pour les hypospades avec une division distale du CS
  - Pas d'uréthroplastie
  - Elimination des tissus dysplasiques situés en aval de la division du CS
  - Pas de courbure iatrogénique chez le jeune adulte dans notre série
- Uréthroplasties utilisant les tissus de la face dorsale (**Onlay**) pour les divisions moyennes et proximales du CS
- **Koyanagi** pour les hypospades périnéaux
  - Evite la prise de greffe du Bracka
  - Les tissus sont vascularisés
  - 2/3 nécessite cependant un 2ème temps chirurgical équivalent à un 2ème temps de Bracka (désunionde l'urèthre reconstruit)
- Le **Thiersch Duplay** garde sa place pour les uréthroplasties courtes avec gouttière profonde et trophique comme celles rencontrées dans les hypospades à prépuce complet (« megameatus ») qui représentent une pathologie très différente de l'hypospade classique.

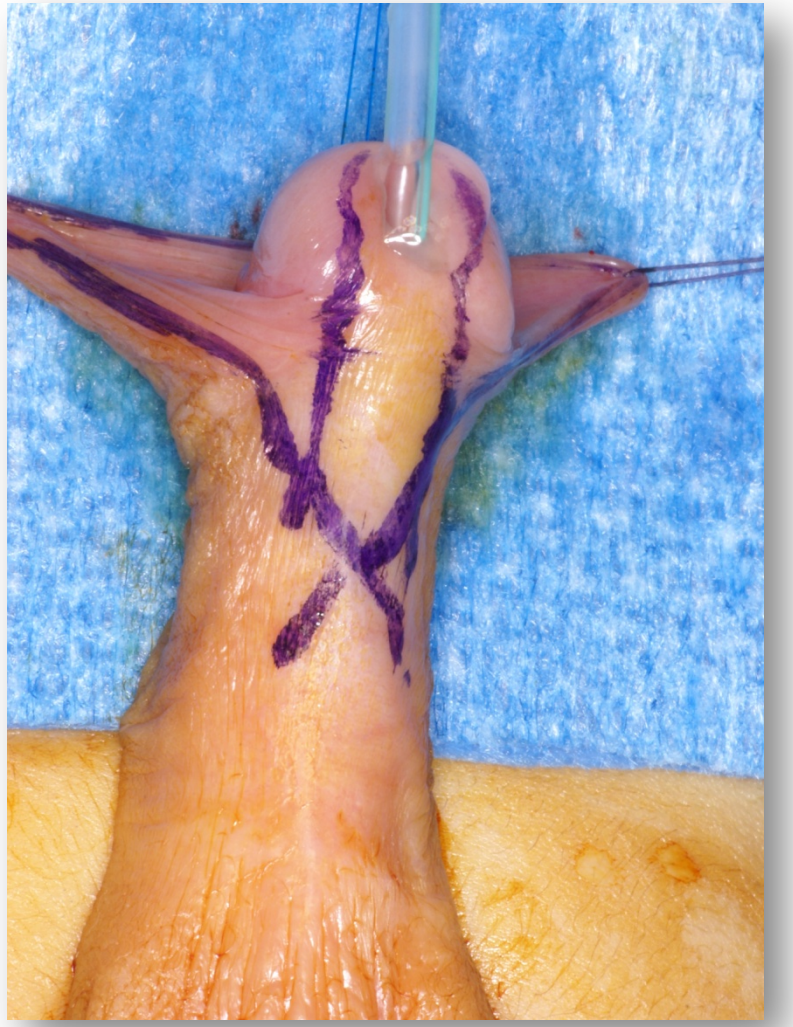
La mobilisation de l’urèthre

- Beck 1898
- Koff 1981

- Beck C. Operative treatment of hypospadias. Ann Surg. 1899; 30:536
- Warwick RT, Parkhouse H, Chapple CR. Bulbar elongation anastomotic meatoplasty (BEAM) for subterminal and hypospadiac urethroplasty. J Urol 1997; 158:1160-1167
- Koff S.A. Mobilization of the urethra in the surgical treatment of hypospadias. J Urol 1981; 125: 394-397

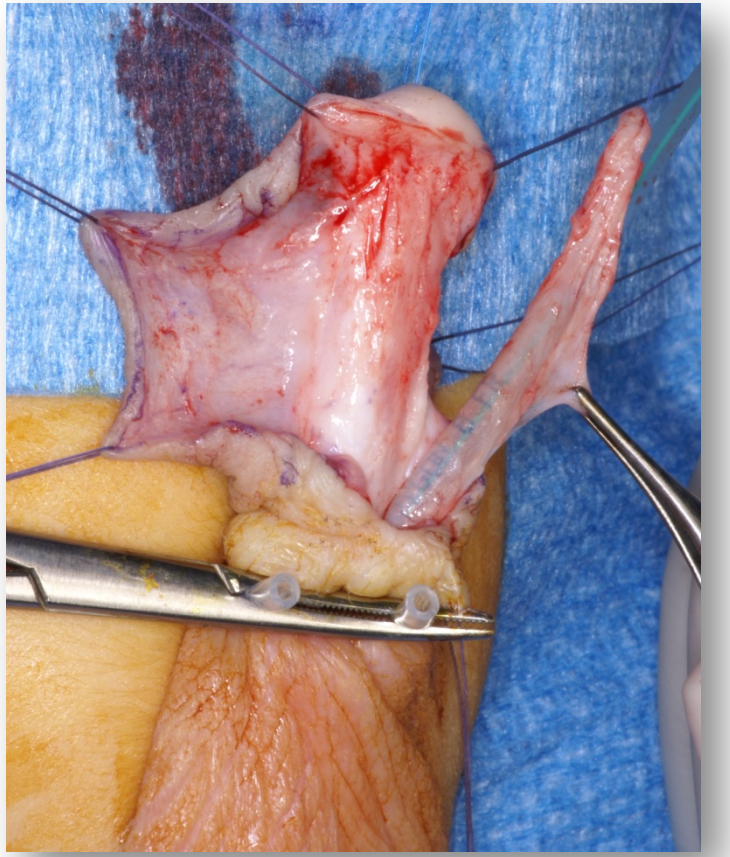
Technique - 1

- Incision lines along the urethral plate prolonged proximally untin reaching the division of the corpus spongiosum
- Extensive dissection of the glans wings
- Penile degloving down to the base



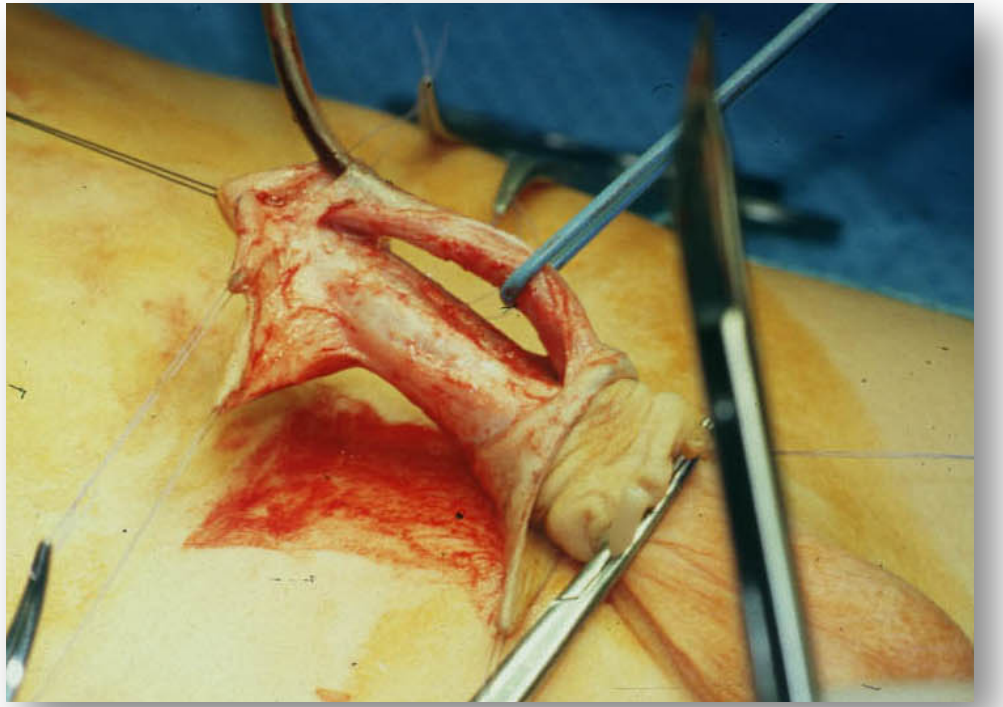
Technique - 2

- The whole urethra is detached from the anterior surface of the corpora down to the peno-scrotal junction
- Excision of the dysplastic urethral plate distal to the division of the corpus spongiosum



Technique - 3

- The healthy urethra is moved toward the tip of the glans et reattached to the corpora from the base to the top to release any traction
- Urethral catheter: 4 days



Patients

- 1999-2012: 158 Koff procedures
- Period: January 1999 – November 2012
- Mean age at surgery: 21 months (12 – 217)
- Selection: Urethroplasty < 1.5 cm with distal urethra surrounded by spongiosum
- 115 primary cases (73%)
- 43 redo cases (27%)
- Same surgeon / same protocol

Results

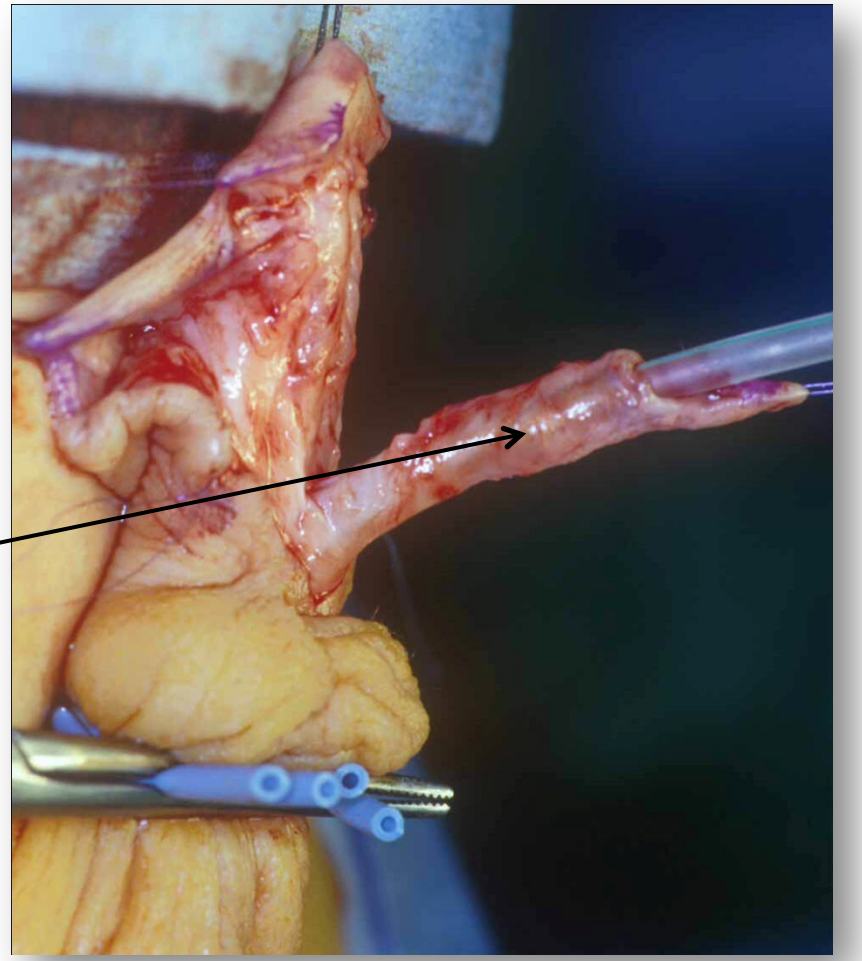
- Mean follow-up: 19 months
- 14 complications requiring further surgery (8,8%)
  - 10 (6.3%) meatal stenosis (3.5% primary cases)
    - 9 required a subsequent meatoplasty
    - 1 required a dilatation
  - 2 (1.2%) glans dehiscences
  - 1 (0.6%)residual curvature requiring further surgery
  - 1 fistula

Discussion Koff 1

- Advantages:
  - No « non-urethral tissue »
  - No urethroplasty as such
  - Elimination of tissues sitting beyond the division of the corpus spongiosum which may not grow at the same pace as tissues sitting proximal to the division or on the dorsum:
    - Significant late urethral inadequacy with techniques solely using ventral tissues (TIP, Duplay)

Discussion - 2

- Complications:
  - Meatal stenosis in 6% cases, mostly at the beginning of our experience
    - Poor distal urethra (not surrounded by corpus spongiosum)



Discussion - 3

- A common concern: Late iatrogenic curvature
  - 1 case in this series: Probably wrong selection as the patient had 2 previous failed Duplay and had an initial curvature of 20° (before urethral advancement).
  - **49/158 patients (1/3) have a fully grown penis without significant clinical curvature**

How does urethral mobilization compare with other techniques

Procedure	Fistula	Meatal stenosis
TIP[12]	3.8% (72/1872)	3.1% (57/1861)
Mathieu[12]	5.3% (79/1496)	0.7% (7/1050)
Onlay[13]	13.5% (18/133)	1.5% (2/133)
Urethral advancement (primary and redo cases, n=158)	0.6% (1/158)	6% (10/158)
Urethral advancement (primary case only, n=115)	0 %	3.5% (4/115)

Other series of urethral mobilization

Autor and year of publication	Nb of patients	Primary/secondary procedure	Mean follow-up (months)	Max follow-up (months)	chordee	Meatal stenosis or retraction
Adorosio 2009	90	Primary	36+/-15	66	None	1/90 (1%)
Paparel 2001	26	Primary	4.6	24	NA	5/26 (25%)
Haberlijk 1997	59	Primary	25	NA	2/64 (3%)	2/64 (3%)
Hammouda 2007	46	Primary	25	38	None	1/46 (2.2%)
Karamusel 2006	9	Secondary procedure	NA	18	1/9 (11%)	None
Marzouk 1999	7	Secondary procedure	NA	18	none	None
Roodsari 2006	74	Primary	39+/-21	72	None	None
Seibold 2007	46	Primary	28.5	NA	None	1/46 (2.2%)
Atala 2002	73	Primary	NA	72	None	2/72 (2.7%)
Present series	**158**	**Both**	**19+/-28**	**165**	**2/158 (1.3%)**	**9/158 (5.7%)**
Present serie: pubert patients	**49**	**Both**	**36+/-43**	**165**	**1/49 (2%)**	**5/49 (10%)**

Urethral advancement in hypospadias with a distal division of the corpus spongiosum: Outcome in 158 cases.
Thiry S, Gorduza D, **Mouriquand P**.
J Pediatr Urol. 2014 Jun;10(3):451-4.

Long-term outcome of hypospadias surgery: current dilemmas.
Mouriquand PD, Gorduza DB, Noché ME, Targnion A.
Curr Opin Urol. 2011 Nov;21(6):465-9

Hypospadias dilemmas: a round table.
Snodgrass W, Macedo A, Hoebeke P, Mouriquand PD.
J Pediatr Urol. 2011 Apr;7(2):145-57.

Does androgen stimulation prior to hypospadias surgery increase the rate of healing complications? - A preliminary report.
Gorduza DB, Gay CL, de Mattos E Silva E, Demède D, Hameury F, Berthiller J, Mure PY, Mouriquand PD.
J Pediatr Urol. 2011 Apr;7(2):158-61

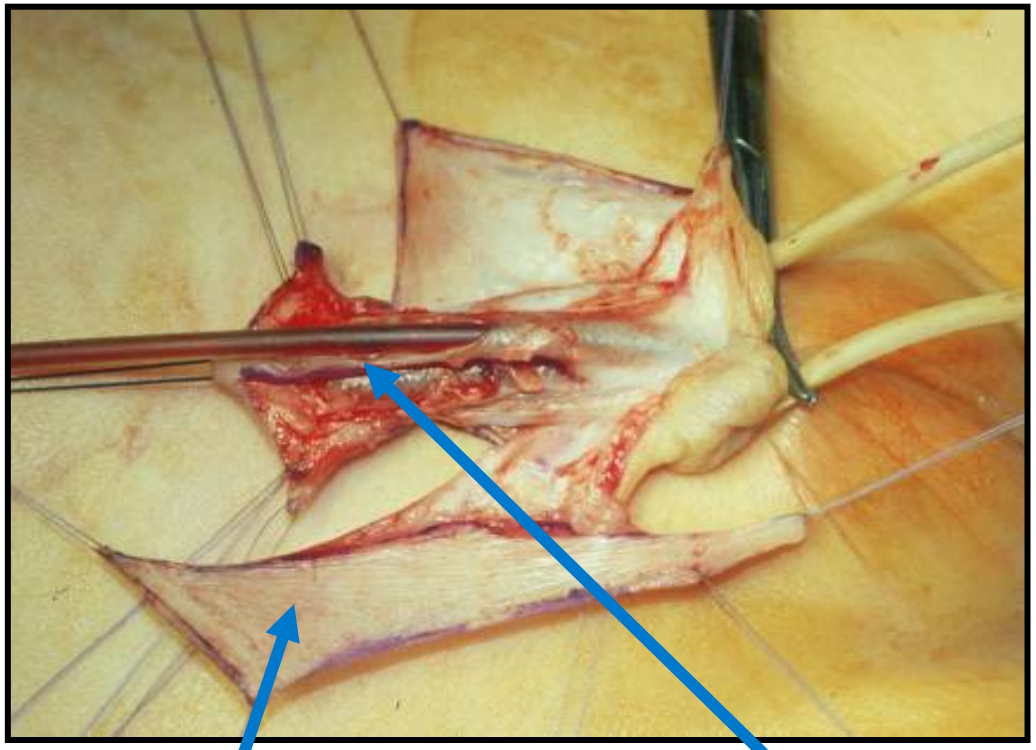
Management of severe hypospadias.
Catti M, Demède D, Valmalle AF, Mure PY, Hameury F, **Mouriquand P**.
Indian J Urol. 2008 Apr;24(2):233-40

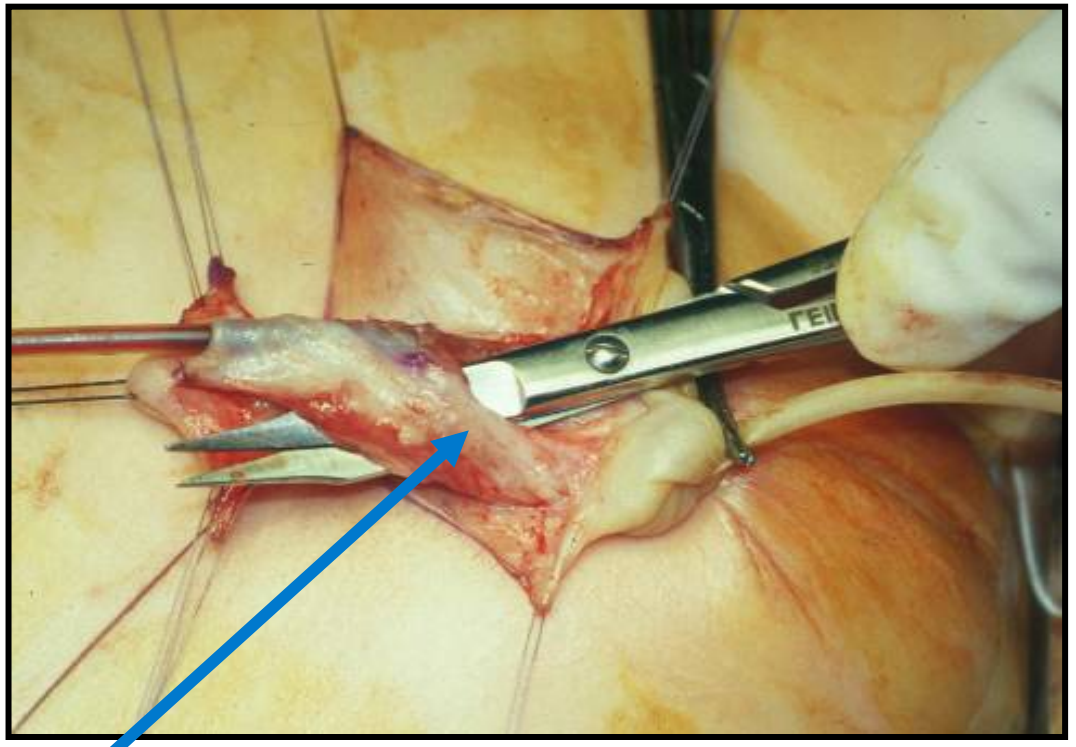
Original Koyanagi urethroplasty versus modified Hayashi technique: outcome in 57 patients.
Catti M, Lottmann H, Babloyan S, Lortat-Jacob S, **Mouriquand P**.
J Pediatr Urol. 2009 Aug;5(4):300-6.

Outcome of severe hypospadias repair using three different techniques.
de Mattos e Silva E, Gorduza DB, Catti M, Valmalle AF, Demède D, Hameury F, Pierre-Yves M, **Mouriquand P**.
J Pediatr Urol. 2009 Jun;5(3):205-11

A study of risk factors for hypospadias in the Rhône-Alpes region (France).
Morera AM, Valmalle AF, Asensio MJ, Chossegros L, Chauvin MA, Durand P, Mouriquand PD.
J Pediatr Urol. 2006 Jun;2(3):169-77

Onlay island flap urethroplasty

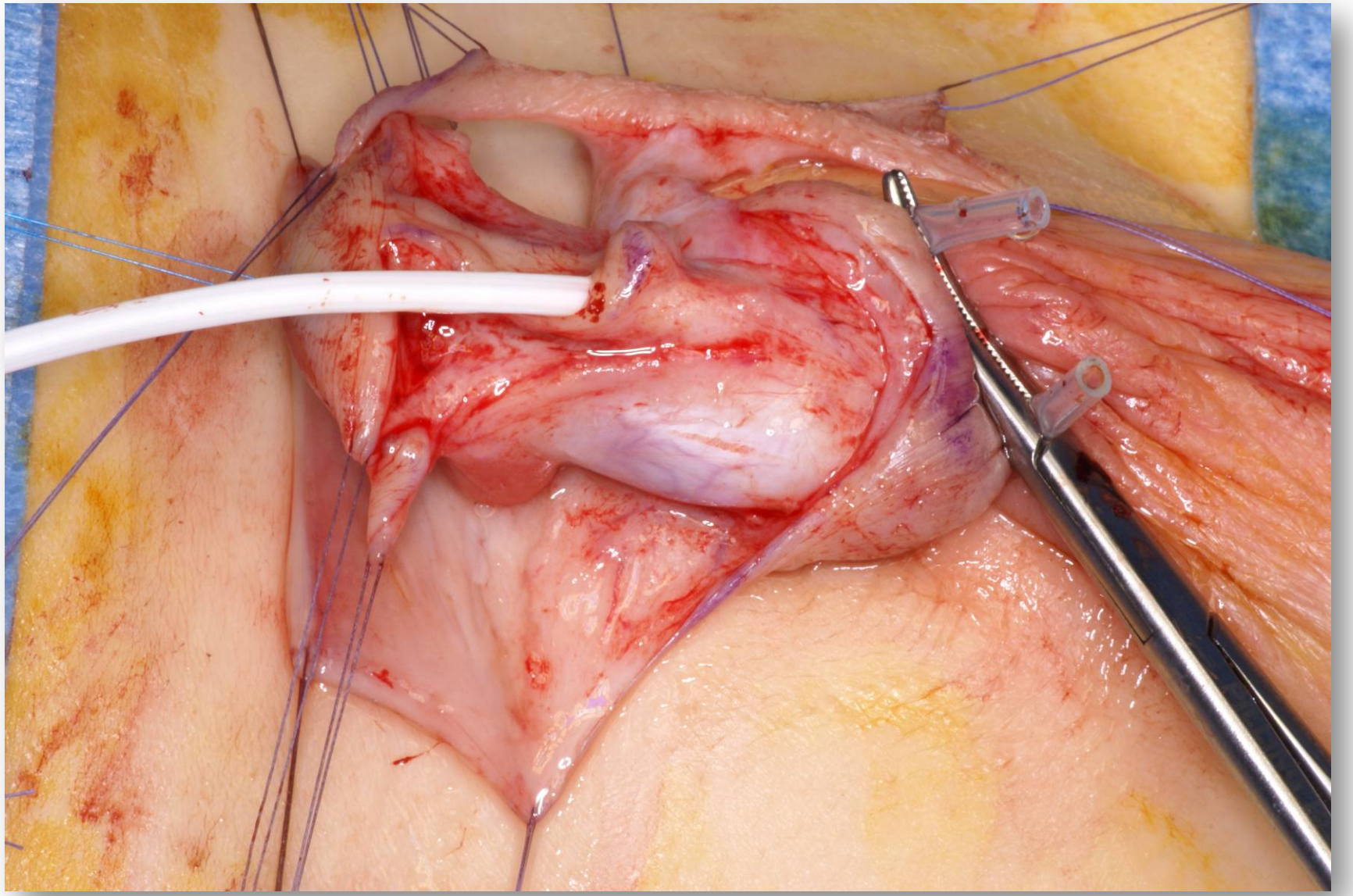


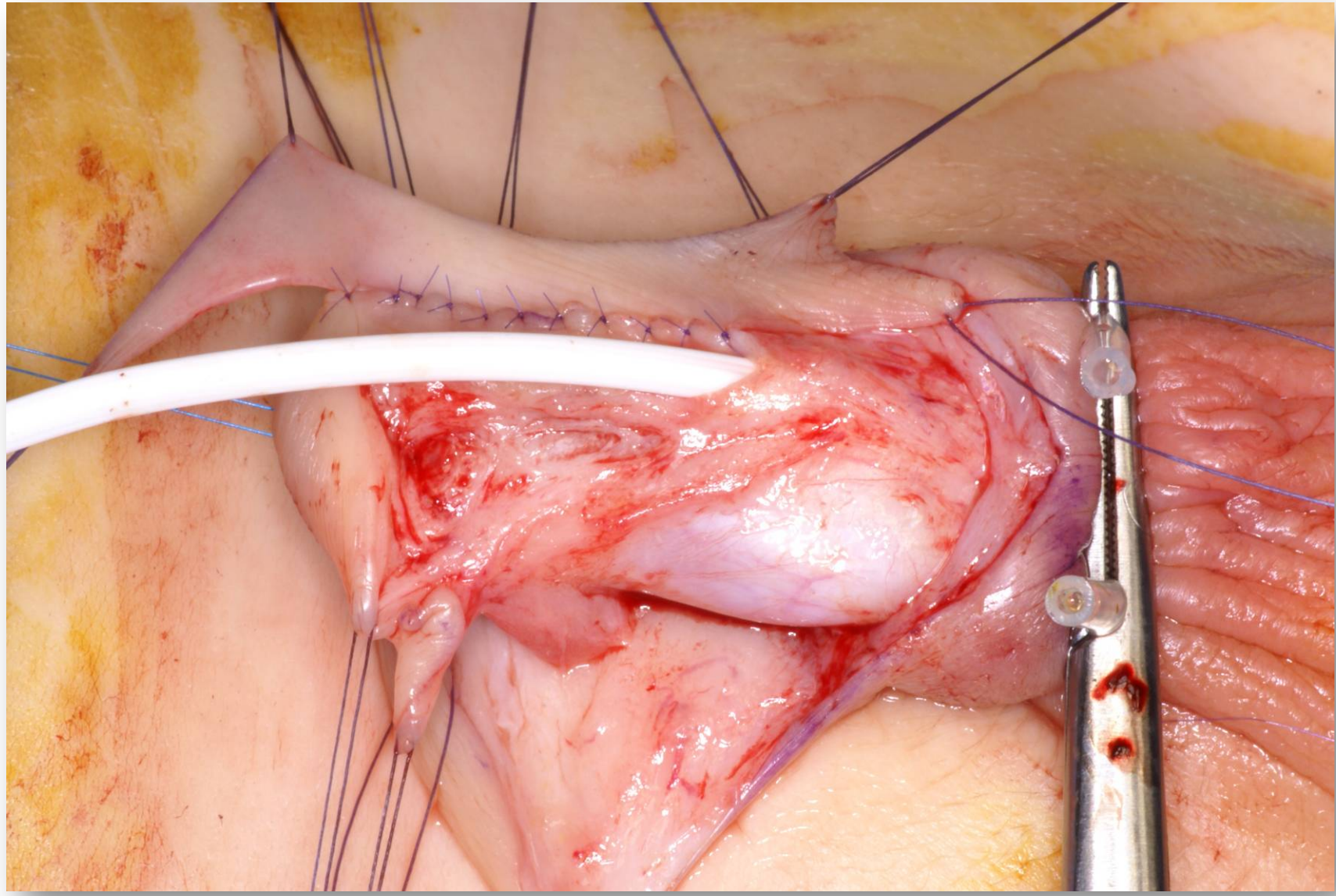


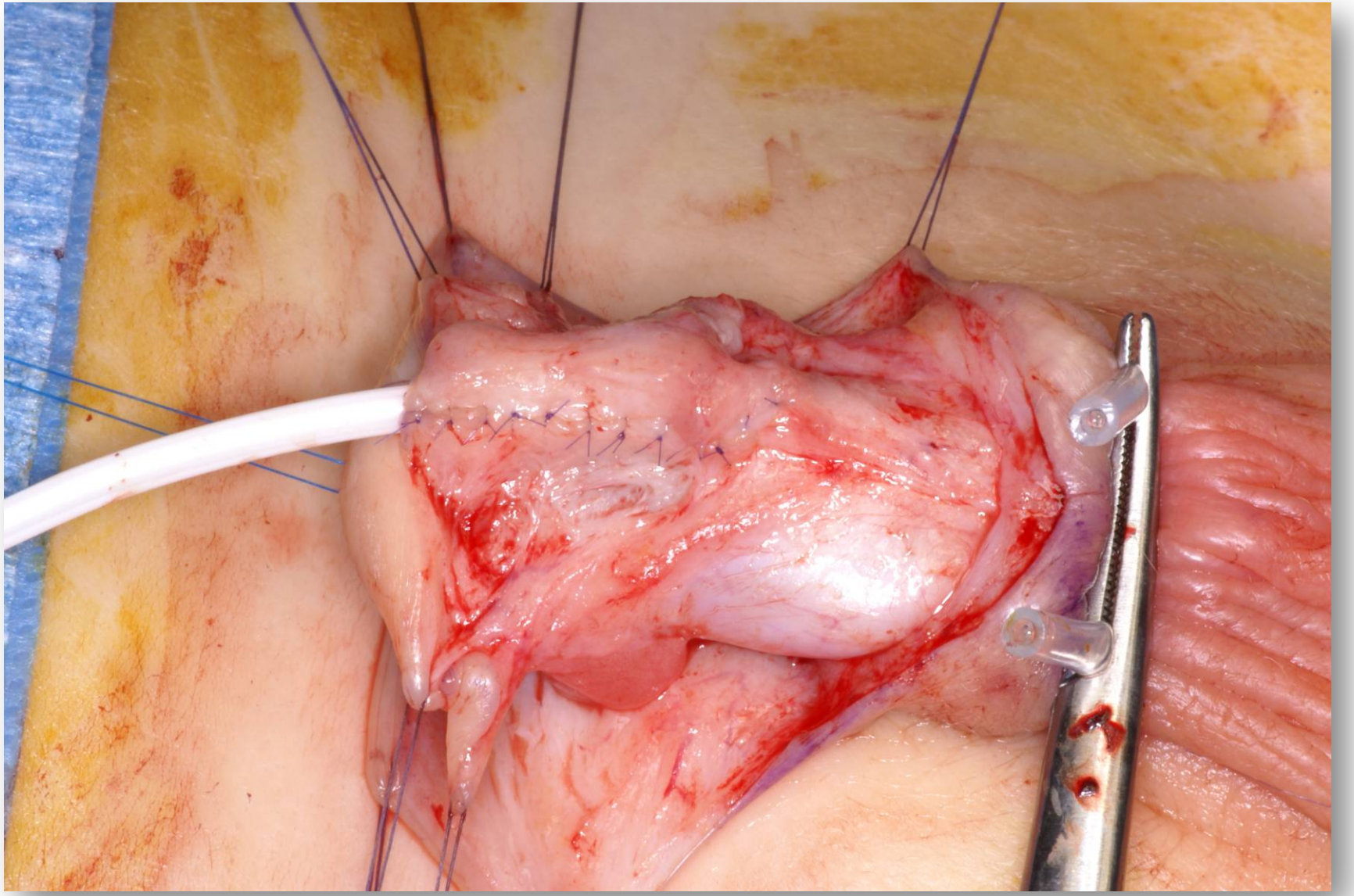
Urethral plate

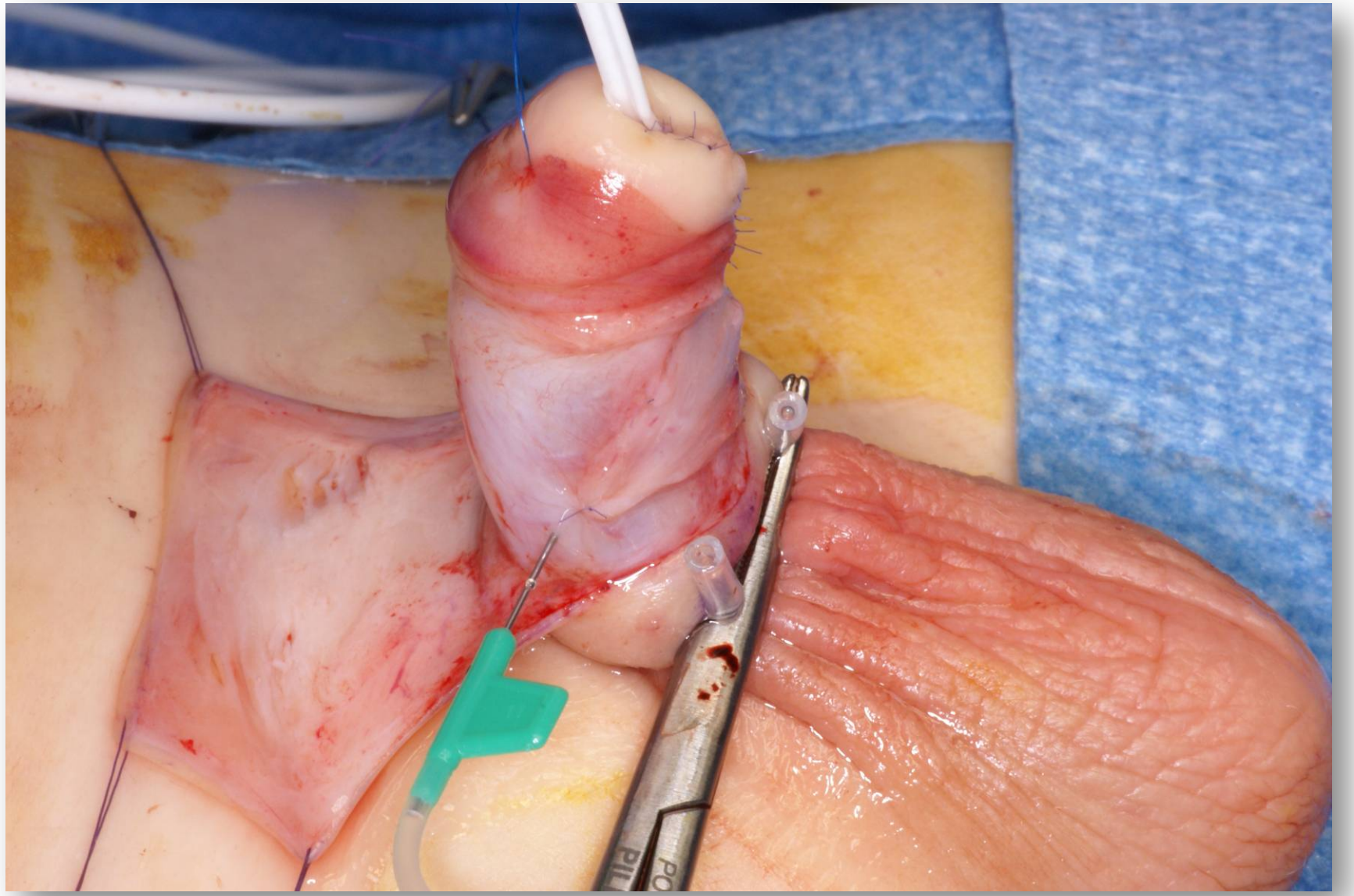
Inner prepuce

Vascular pedicle









Onlay / Duckett - results

- Elbakry (BJUI 88: 590-595, 2001): 42% complications
  - 5 breakdowns (7%)
  - 17 fistulæ (23%)
  - Urethral strictures (9%)
  - Urethral diverticulæ (4%)
- Asopa / Duckett tube
  - 3.7% (El-Kasaby J Urol 136: 643-644, 1986)
  - 69% (Parsons BJU 25: 186-188, 1984)
  - 15% (Duckett - 1986)

Onlay

- 374 Onlay (Baskin)
  - 50 (13%): persistent chordee after degloving the penis
  - 18/184 (9.8%) in our series
  - Fistulae: 6%
  - 15% in our series
- Other publications: 20% to 45% complications
- 28.5% in our series

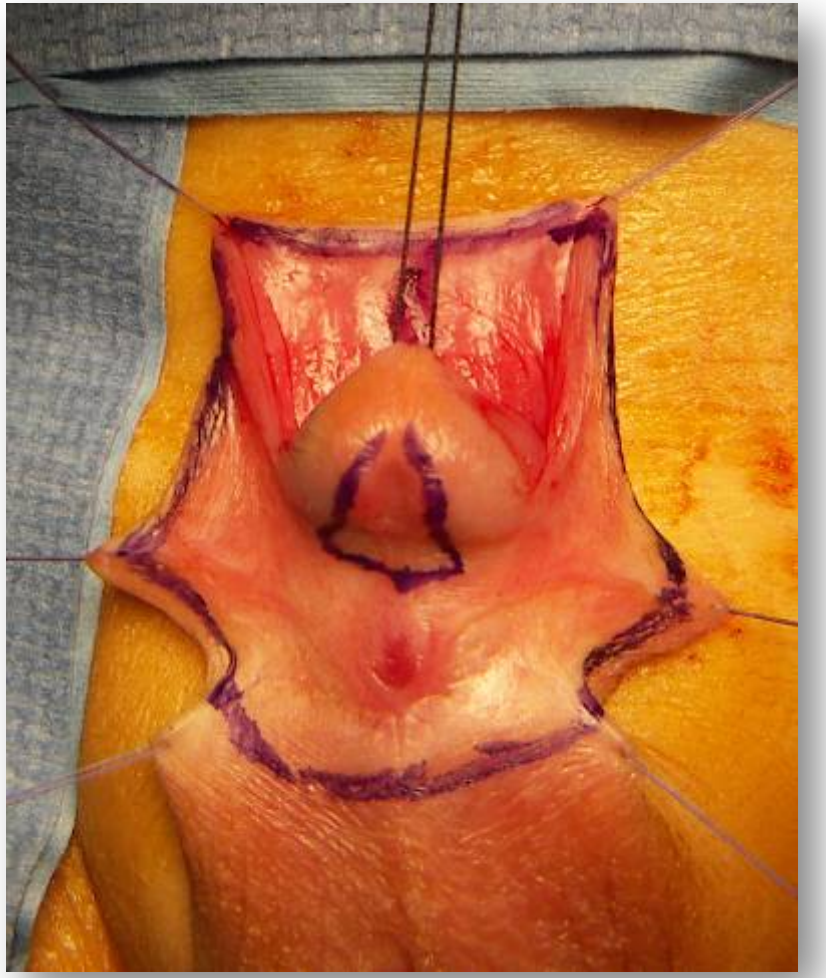
Outcome Onlay

- Onlay:
  - 126 patients
  - 26/126 complications related to a deficient healing process (i.e. fistula & dehiscence): **20.6%**
  - 17/96 if no stimulation: **17.7%**
  - 9/30 if stimulation: **30%**
  - If surgery performed **> 3 months** after stimulation: 5/23: **21.7%**
  - If surgery performed **< 3 months** after stimulation: 4/7: **57%**

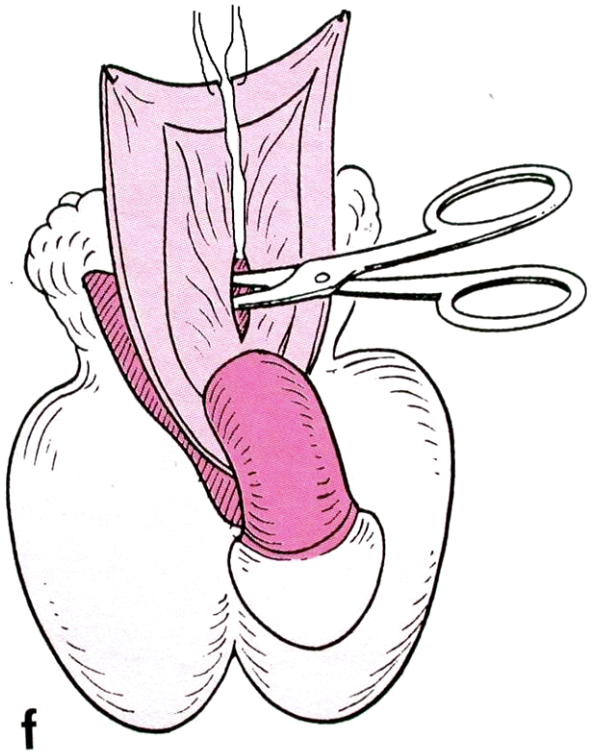
Koyanagi / Hayashi

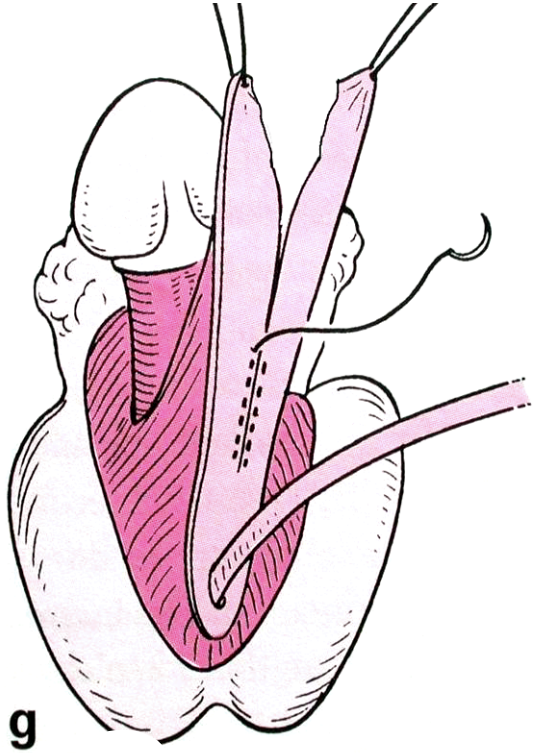
Major hypovirilization
of the genital tubercle

30 à 50% re-do surgery



Original Koyanagi procedure

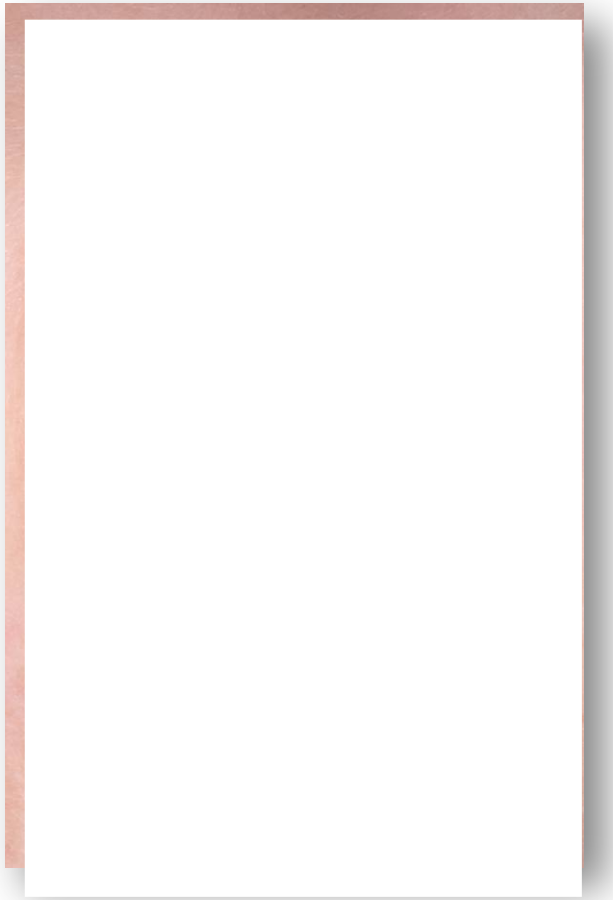




1. Satisfactory outcome

10/26 pts (38.5%)

- No re-operations
- Good stream
- Straight penis
- Excellent cosmetic result
- Apical meatus in 6/10
- Glanular meatus in 4/10



Complications Koyanagi

16/26 pts (61.5%)

11 Urethral dehiscence

- Glanular urethra 3
- Penile urethra 6
- All reconstructed urethra 2

5 Fistulae

- Proximal 3
- Mid-shaft 2

Dysuria and UTIs in 12/16

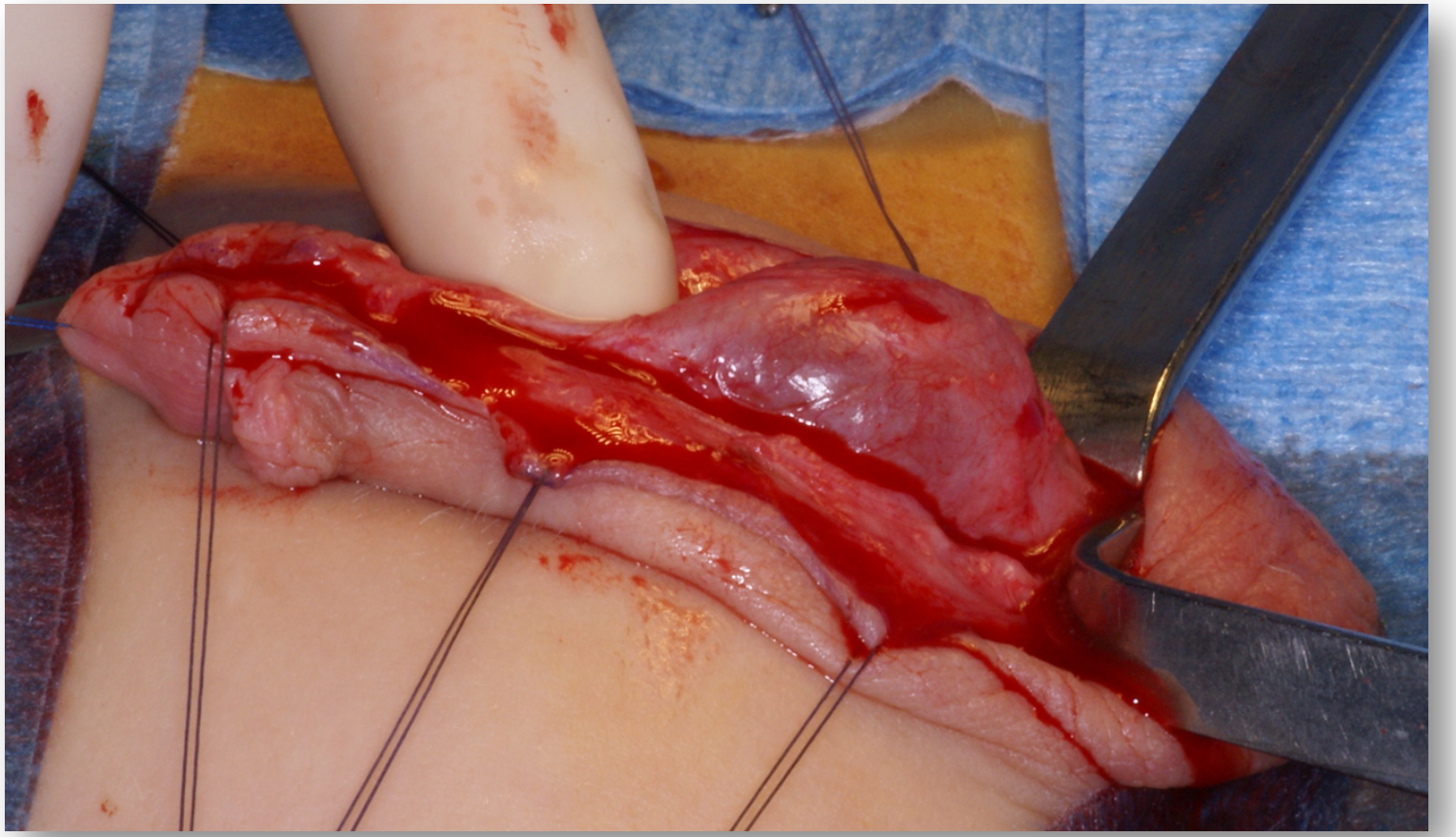
11 Urethral stenoses

- Distal 4
- Reconstructed urethra 2
- Proximal anastomosis 3

7 Urethroceles

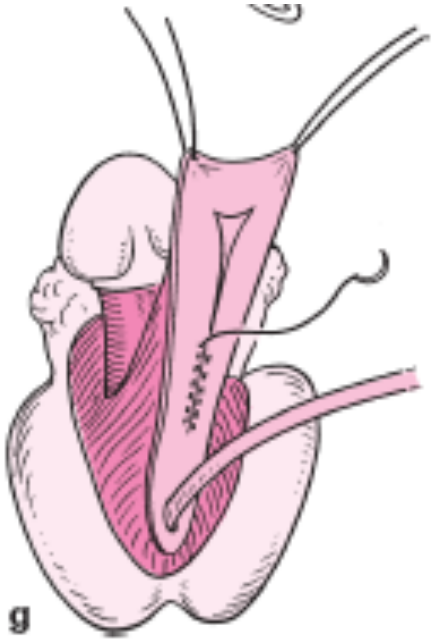
- Reconstructed urethra 4
- Native urethra 3

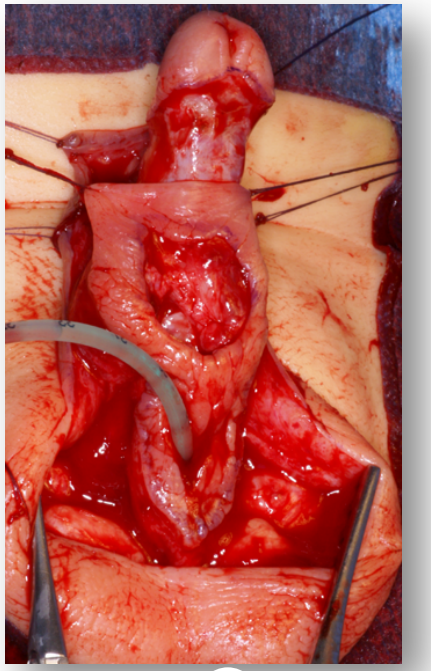
Urethrocele

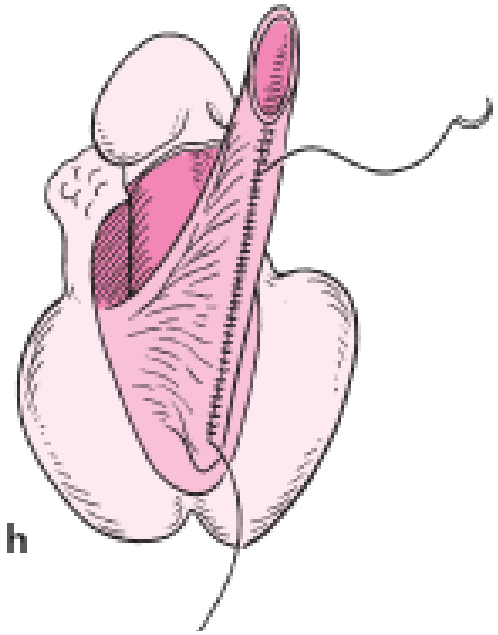


Koyanagi Hayashi

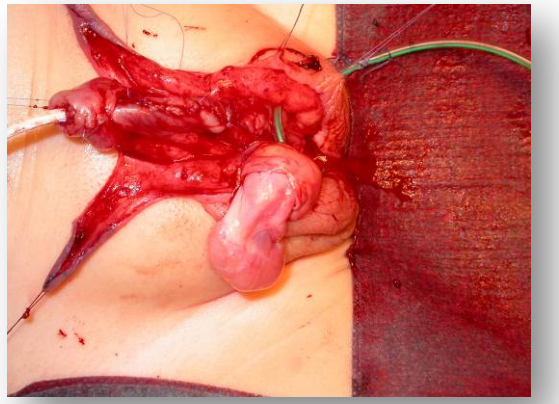
- Modified Koyanagi's technique might provide better distal vascularisation and functional results



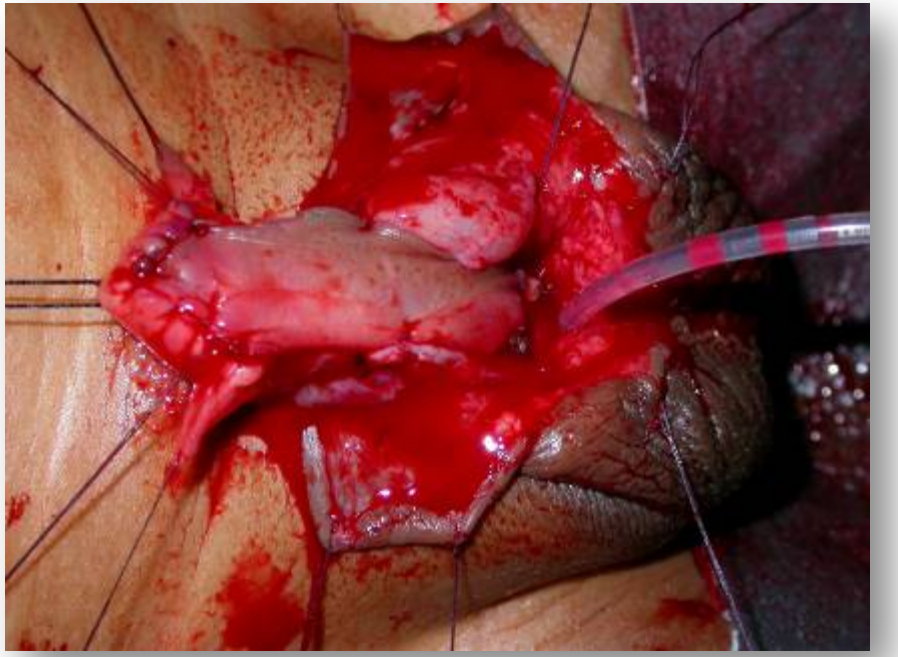




Koyanagi



Cloutier Bracka



Proximal division of the corpus spongiosum

Bracka + buccal graft

2-stage procedures

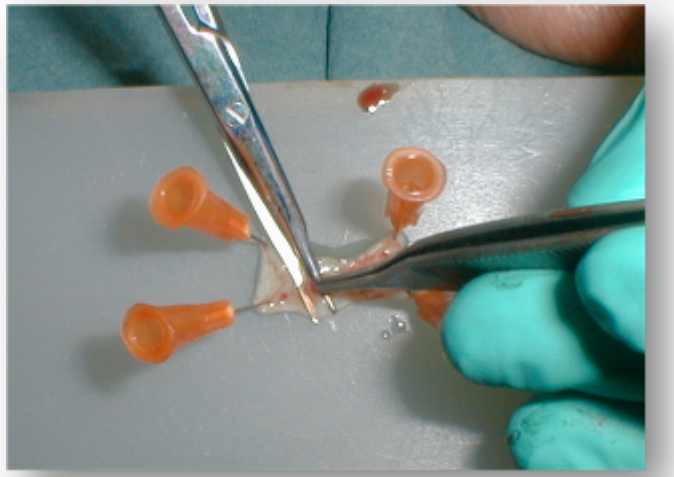
- 1st stage: Correction of chordee + grafting of the ventral radius using skin or buccal mucosa
  - 81% complete take
  - 19% focal scar / contracture
- 7% stricture rate

- Bracka A. BJU (Suppl. 3) 31-41, 1995
- Cloutier A. Plast Reconstr Surg 30: 368-373, 1962

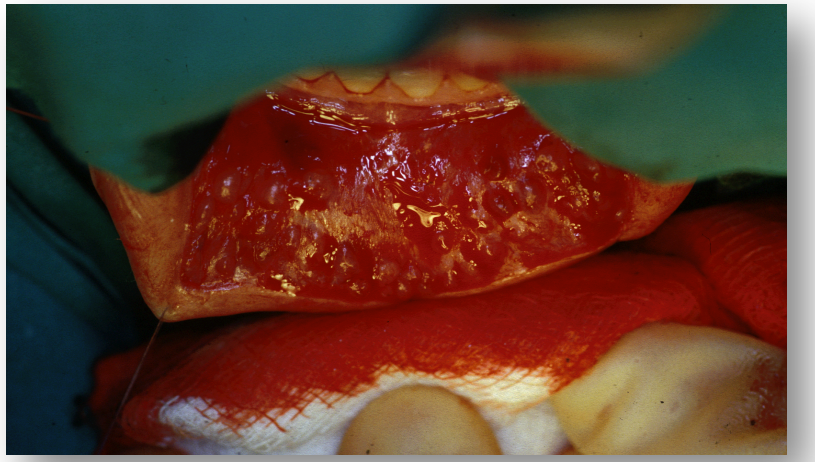
Hypospadias - Procedures for cripple hypospadias

- No standardized procedures
- Personal experience of the surgeon
- Importance of a uro-endocrine approach of complex cases to increase the healing abilities of the penile tissues

Buccal (redo)



Buccal graft urethroplasty

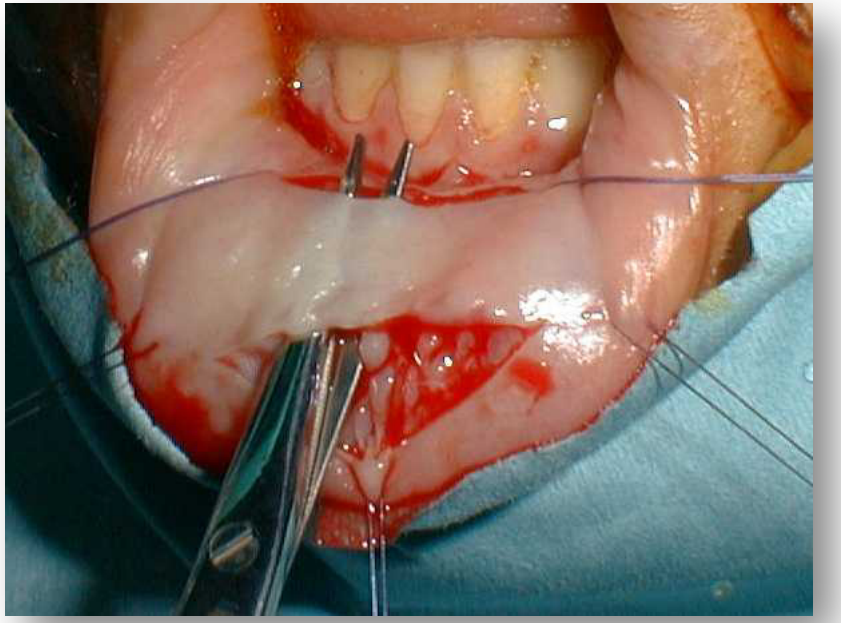


Buccal - Results

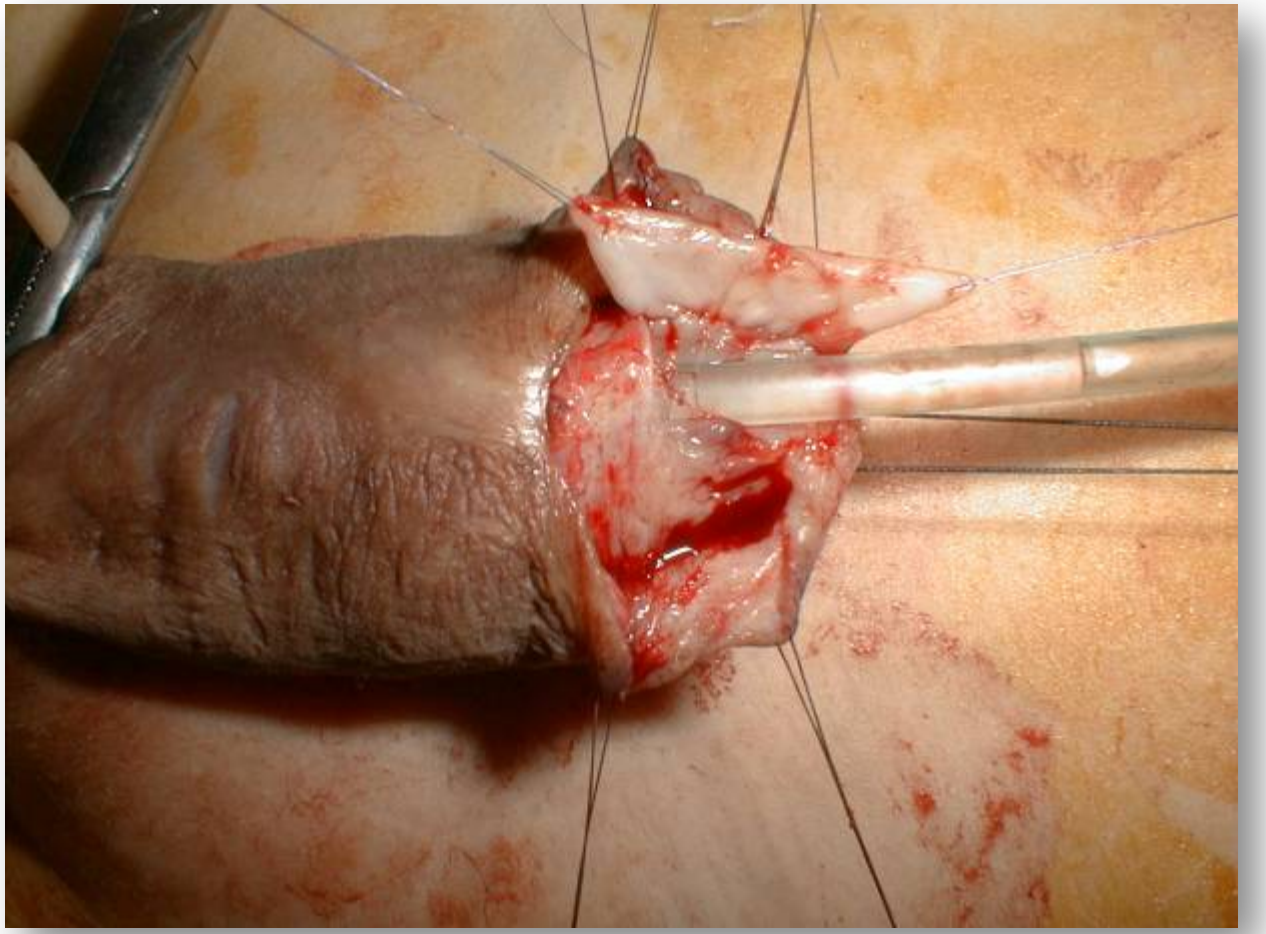
- 57% complications (30 patients) after 5 year FU Duckett - J Urol 153: 1660-1663,1995
  - Meatal stenosis (5)
  - Strictures (7)
  - Fistulæ (2)
  - Breakdown (1)
- **In our series:** 14/25 pts: **53.8%**

Outcome Buccal

- Buccal
  - Overall results: 14/25: **54%** complications
  - With stimulation: 7/10: **70%**
  - Without stimulation: 7/15: **47%**



Buccal (redo)

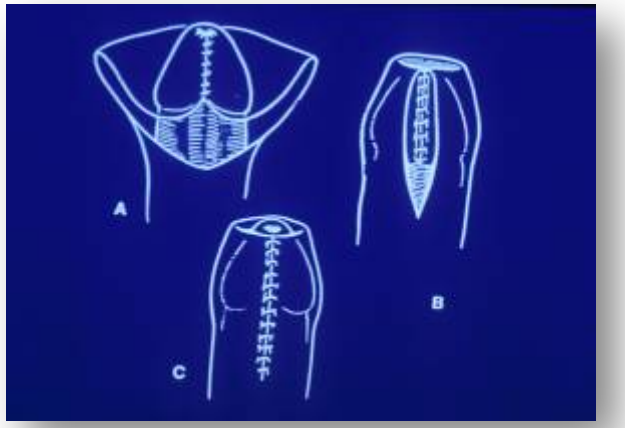


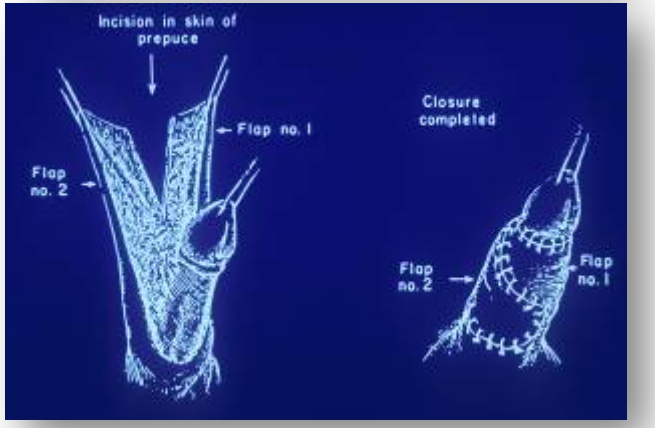

Koff Redo

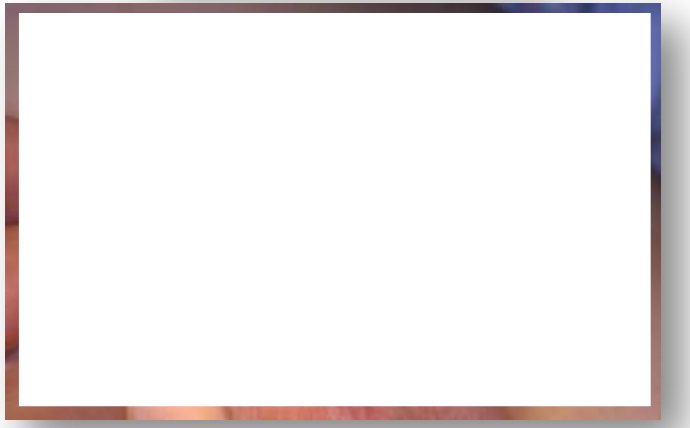
Step 3: Reconstruction of the penile radius

- Spongioplasty
- Meatoplasty
- Glanuloplasty
- Skin cover
- Circumcision or preservation of the foreskin

Skin cover

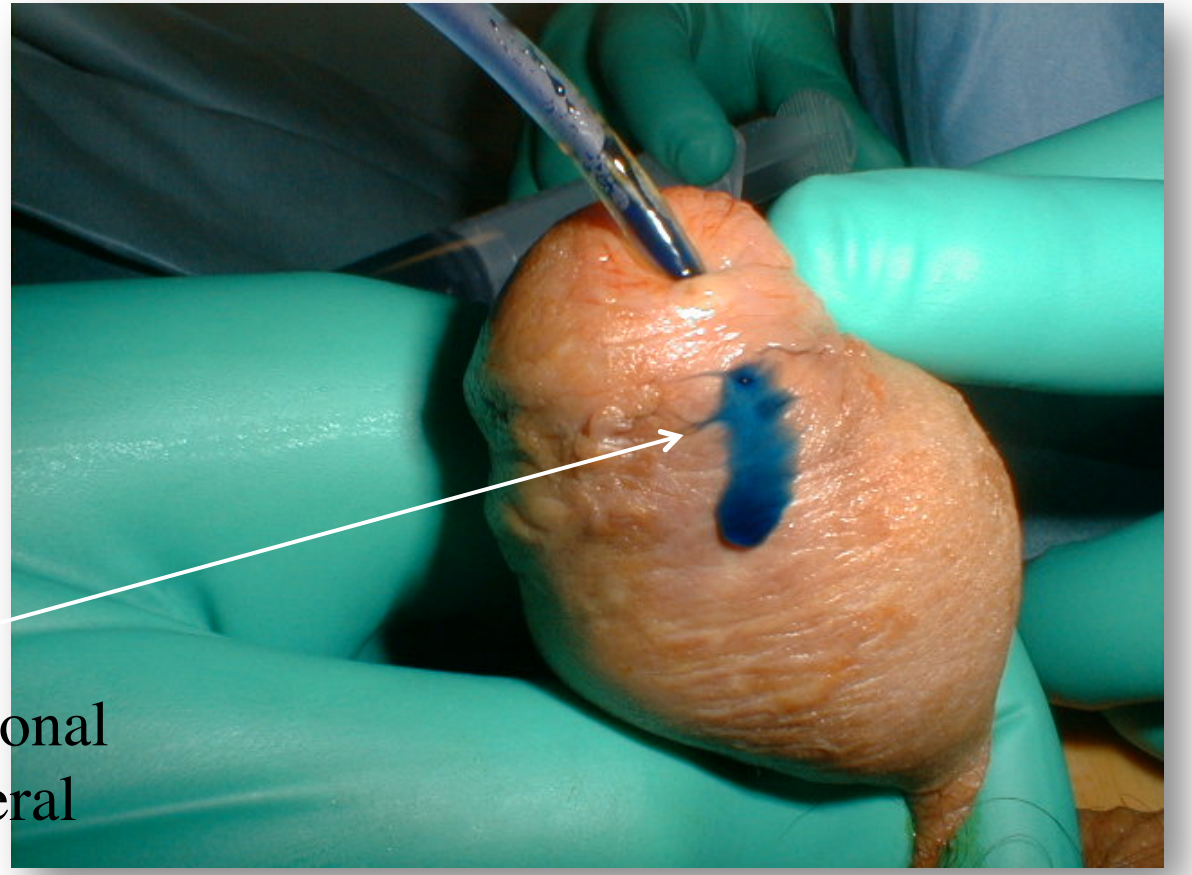

A
B
C


Incision in skin of prepuce
Flap no. 1
Flap no. 2
Closure completed
Flap no. 2
Flap no. 1



Bad cosmetic result

Fistula



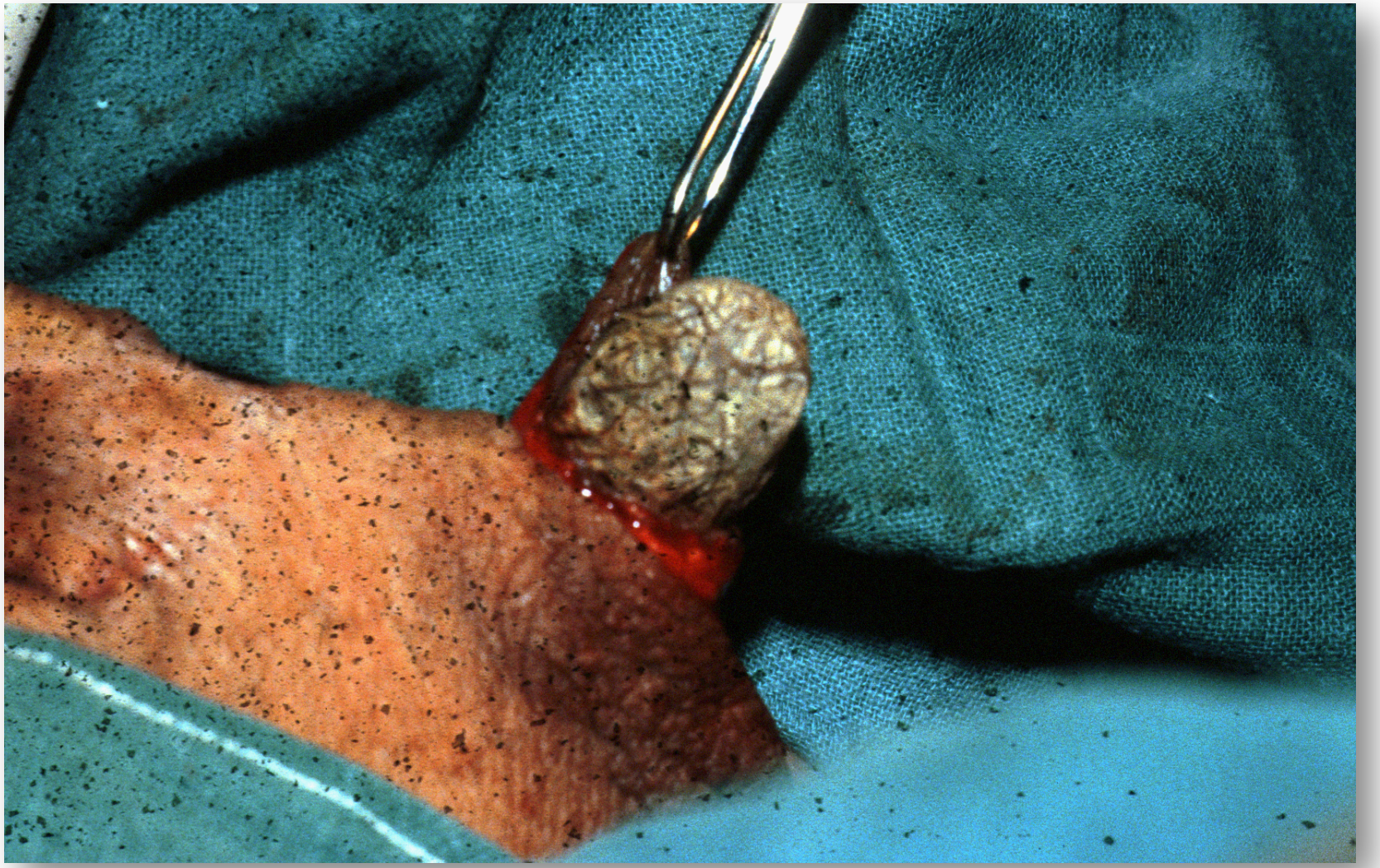
Often coronal
Often lateral

Urethral stenosis + urethrocele

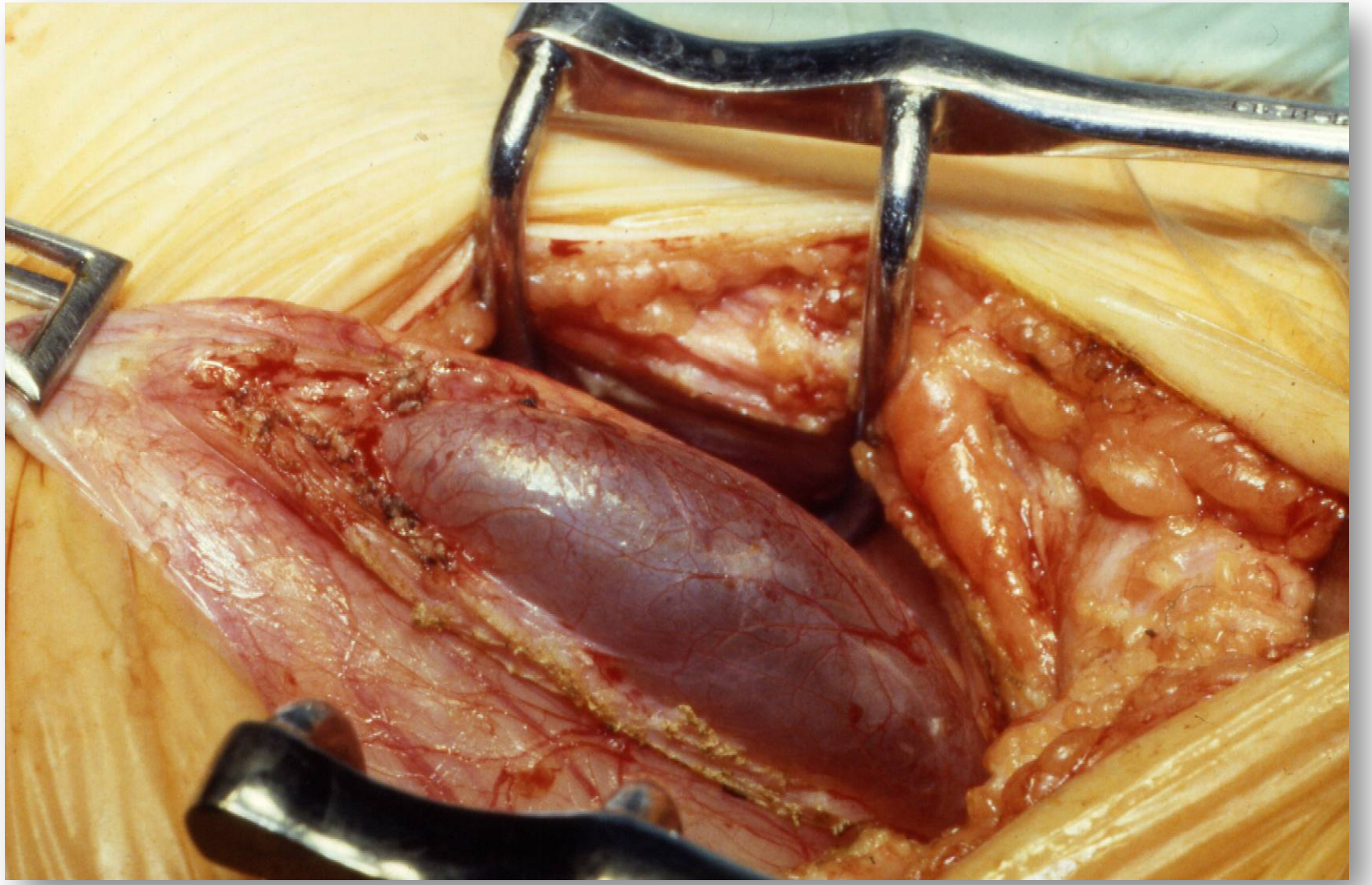
Glans scab

infection

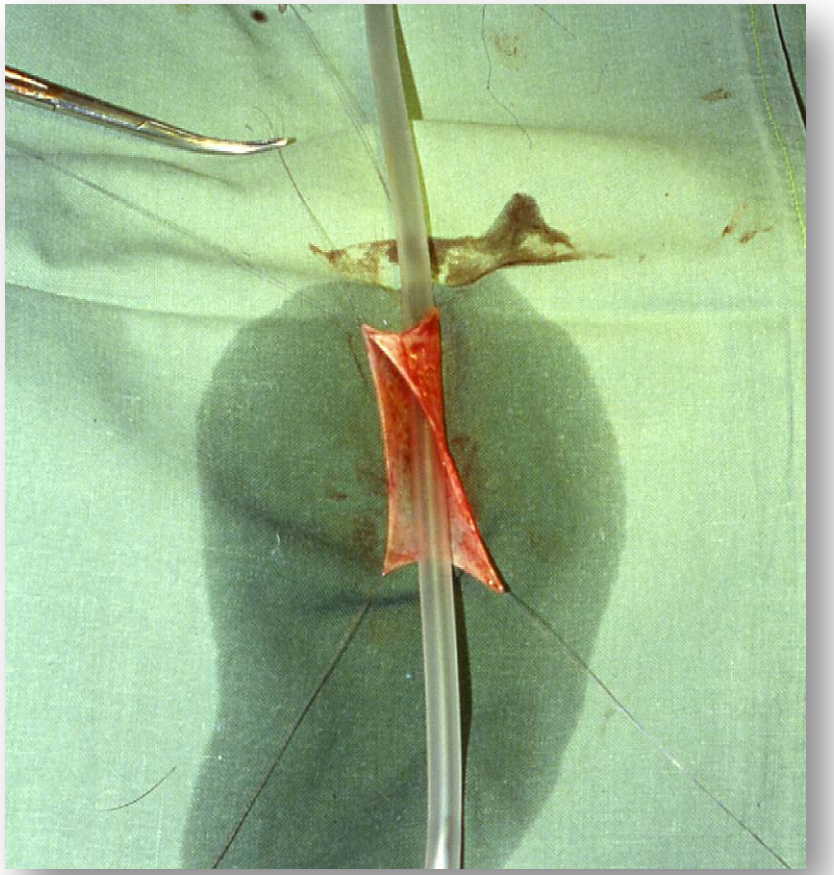
infection

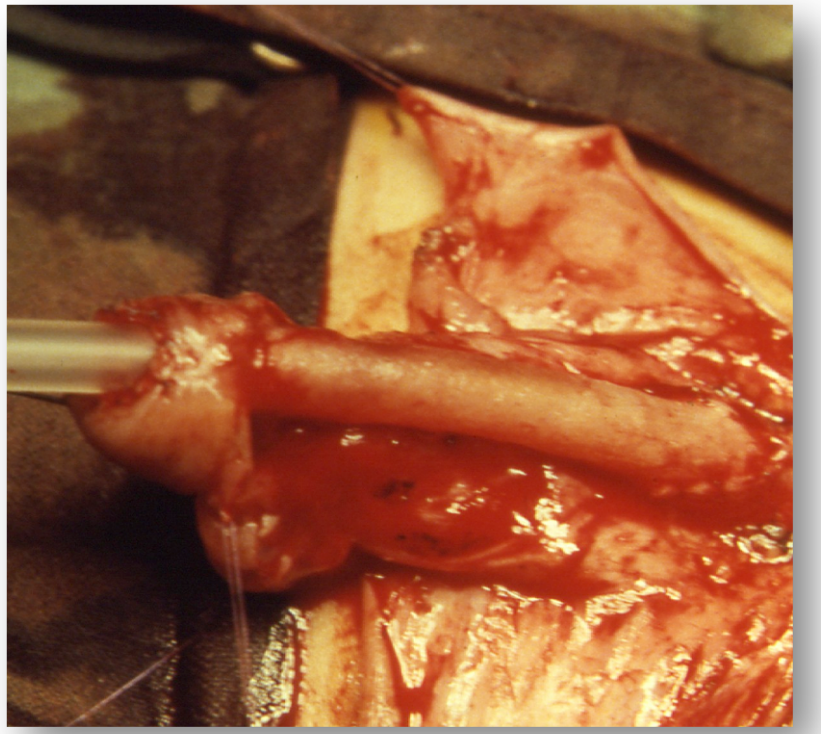


Urethral stone



Bladder graft mucosa





Bladder graft mucosa

Hypospadias severity

Previous surgery

Division of the corpus spongiosum :

Distal
Midshaft
Proximal

Curvature

Moderate
Significant

Position of the urethral meatus

Distal
Midshaft
Proximal

Size of the penis

< 25 mm (<1year)
> 25 mm (<1 year)

Glans width

< 20mm
>20 mm

Labelled endocrine / genetic disorder

Preoperative stimulation

Nature

HCG
Testosterone
DHT
Other

Time lap before surgery

< 3 months
>3months

Dose

Nb hypospadias / year

< 10

10-50

>50

Technique

Urethroplasties solely using ventral tissues

Thiersch Duplay
TIP
Mathieu

Urethroplasties combining ventral and dorsal tissues

Onlay
Duckett
Koyanagi

Free grafts urethroplasties

Preputial Bracka
Buccal mucosa
Bladder mucosa
Other

Urethral mobilization

Koff
Turner Warwick

Complications

Cosmetic

Healing complications

Fistula
Dehiscence

Urethral flow impairment

Dysuria
Urethrocele
Stenosis

Persistent curvature

Ventral
Lateral
Twist

Sexual dysfunction

Outcome

Surgeon

Good

Fair

Bad

Patient

Good

Fair

Bad

Challenges

- Long-term results of TIP are still awaited
- No agreement on **initial evaluation** of hypospadias
  - Which ones require a biological screening ?
  - Which ones require a pre-operative hormonal stimulation ?
- No agreement on the **choice of urethroplasty**
  - The myth of a universal type of repair should be fought
- No consensual **evaluation of hypospadias surgery**
  - How ?
  - How long ?

Lyon DSD team / CNMR DSD

- **Endocrinologists**
  - Pierre Chatelain
  - Marc Nicolino
  - Claire-Lise Gay
  - Patricia Bretones
  - Michel David
- **Biologists**
  - Yves Morel
  - Ingrid Plotton
  - Véronique Tardy
  - Maguelone Forest
- **Geneticists**
  - Patrick Edery
  - Massimilio Rossi
  - Marianne Till
- **Pathologists**
  - Frédérique Dijoud
  - Raymonde Bouvier
- **Radiologists**
  - Jean-Pierre Pracros
  - Laurent Guibaud
- **Psychologists**
  - Jean-Yves Tamet
  - Corinne Chich
- **Surgeons**
  - Pierre Mouriquand
  - Daniela Gorduza
  - Delphine Demède
  - Pierre-Yves Mure
- **Anesthetists**