

# Risk factor and principles of urogenital fistula formation and repair in prostate cancer treatment

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# Urinary Tract Fistula

- Most fistula in the industrialized world are **iatrogenic**.

Congenital anomalies, malignancy, inflammation and infection, radiation therapy, **iatrogenic (surgical)** or external tissue trauma, ischemia, parturition, and a variety of other processes

- Considerable **emotional and psychologic distress** often accompanies the diagnosis and subsequent treatment.

# Urinary Tract Fistula

- Urogynecologic Fistula

Vesicovaginal, Ureterovaginal, Vesicouterine, Urethrovaginal Fistula

- Uroenteric Fistula

Vesicoenteric, Ureteroenteric, Pyeloenteric, **Urethrorectal (Rectourethral) Fistula**

- Urovascular Fistula

Renovasular, Pyelovasular, Ureterovascular Fistula

- Others.. Urinary leak after renal preservation/ renal transplantation surgery

# Risk factor

	Patients, n (%) <sup>a</sup>		p value
	No rectal injury	Rectal injury	
Total number of patients	611 394 (99.5)	2900 (0.5)	
Age			0.01
<58 yr	218 272 (35.8)	902 (31.1)	
59–65 yr	210 276 (34.4)	975 (33.6)	
≥66 yr	181 392 (29.8)	1023 (35.3)	
Race			<0.001
White	377 428 (61.7)	1581 (54.5)	
African ancestry	55 333 (9.1)	445 (15.3)	
Hispanic	27 014 (4.4)	148 (5.1)	
Other	23 724 (3.9)	144 (5.0)	
Unknown	127 896 (20.9)	582 (20.1)	
Insurance status/payer type			<0.001
Medicare	183 644 (30.0)	1067 (36.8)	
Medicaid	11 481 (1.9)	91 (3.1)	
Private/self	398 253 (65.1)	1648 (56.8)	
Other	17 147 (2.8)	87 (3.0)	
Elixhauser comorbidity score			0.3
0	300 734 (49.2)	1441 (49.7)	
1	182 855 (29.9)	793 (27.3)	
≥2	127 806 (20.9)	666 (23.0)	
Hospital region			0.1
Northeast	118 384 (19.4)	509 (17.6)	
Midwest	149 442 (24.4)	632 (21.8)	
South	206 965 (33.9)	1143 (39.4)	
West	136 603 (22.3)	616 (21.2)	

Hospital location			0.001
Rural	32 954 (5.4)	255 (8.8)	
Urban	574 946 (94.0)	2616 (90.2)	
Hospital type			0.001
Nonteaching	220 999 (36.2)	1278 (44.1)	
Teaching	386,901 (63.3)	1593 (54.9)	
Annual hospital RP volume			<0.001
Low (1–43)	334 524 (54.7)	2028 (69.9)	
High (>43)	276 871 (45.3)	872 (30.1)	
Surgical approach			<0.001
Open	412 182 (67.4)	2379 (82.0)	
Laparoscopic	38 084 (6.2)	142 (4.9)	
Robotic	161 129 (26.4)	379 (13.1)	
Year			0.01
2003–2005	153 859 (99.5)	838 (0.6)	
2006–2008	231 932 (99.5)	1090 (0.5)	
2009–2012	225 603 (99.6)	972 (0.4)	
<u>Obesity (BMI &gt;30 kg/m<sup>2</sup>)</u>	35 148 (5.7)	102 (3.5)	0.02
<u>Metastatic disease</u>	11 543 (1.9)	122 (4.2)	0.001
<u>Benign prostatic hyperplasia</u>	4772 (0.8)	54 (1.9)	0.004
<u>History of radiation therapy</u>	1048 (0.2)	10 (0.3)	0.3
<u>History of enteritis</u>	1179 (0.2)	10 (0.3)	0.4

RP = radical prostatectomy; BMI = body mass index.

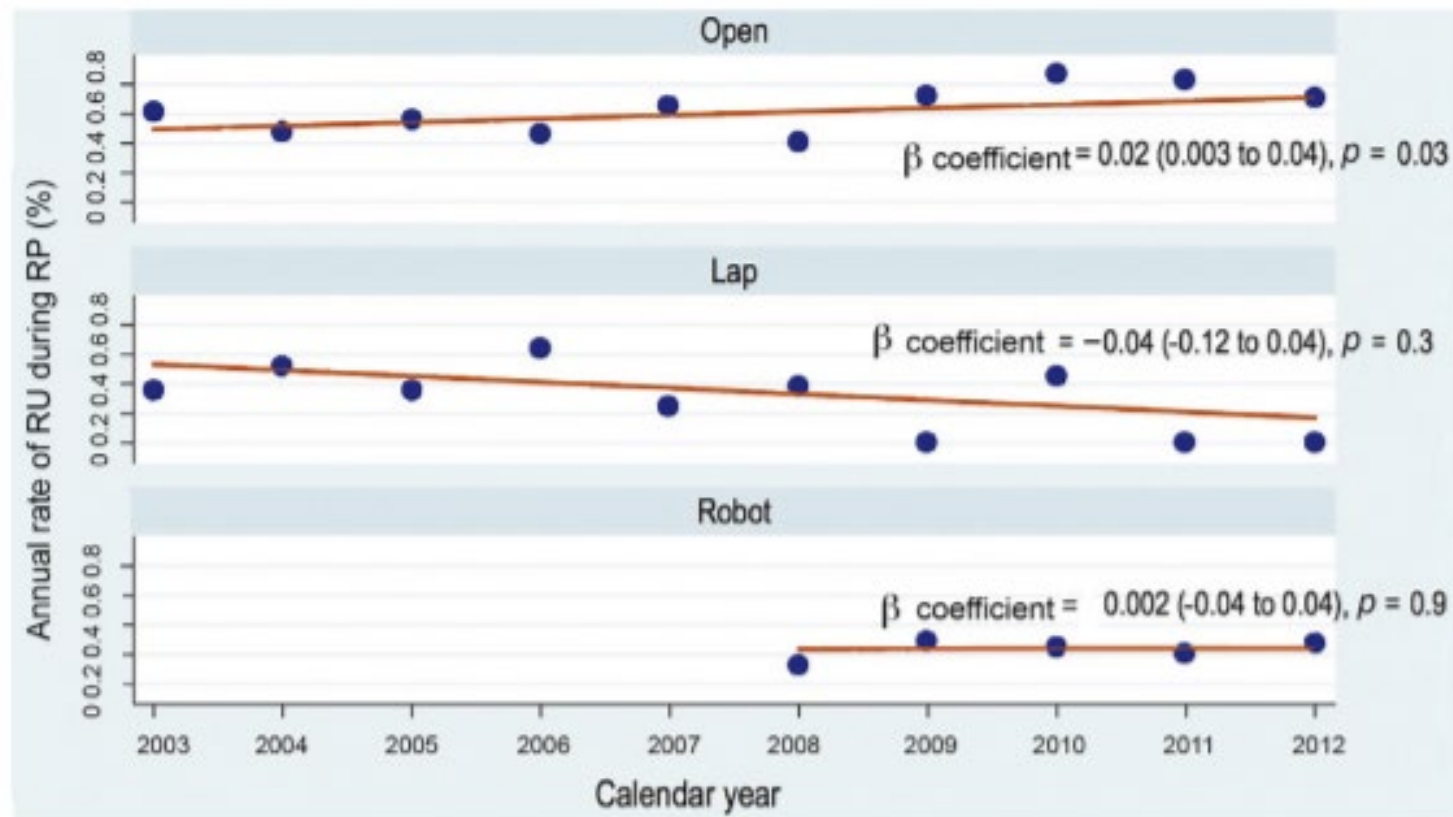
<sup>a</sup> Cells that do not sum to the total number for the column represent missing data from the National Inpatient Sample database.

# Risk factor

**Table 3 – Multivariable analysis of risk factors for rectal injury during radical prostatectomy**

	OR (95% CI)	p value
Age in years	1.00 (0.99–1.02)	0.5
Race		
White	Reference	
<u>African ancestry</u>	<u>1.60 (1.21–2.13)</u>	<u>&lt;0.01</u>
Hispanic	1.21 (0.82–1.78)	0.3
Other	1.27 (0.80–2.03)	0.3
Unknown	0.91 (0.69–1.19)	0.5
Elixhauser comorbidity score		
0	Reference	
1	0.94 (0.74–1.18)	0.6
≥ 2	1.05 (0.82–1.36)	0.7
Insurance status/payer type		
Medicare	Reference	
Medicaid	0.85 (0.43–1.67)	0.6
Private/self	0.75 (0.58–0.97)	0.03
Other	1.00 (0.60–1.67)	0.9
Surgical approach		
Open	Reference	
Laparoscopic	0.72 (0.44–1.17)	0.2
<u>  Robotic</u>	<u>0.38 (0.29–0.50)</u>	<u>&lt;0.01</u>
Teaching hospital (vs nonteaching)	0.89 (0.71–1.10)	0.3
<u>High-volume hospital (vs low-volume)</u>	<u>0.58 (0.46–0.72)</u>	<u>&lt;0.01</u>
Obesity (body mass index >30 kg/m <sup>2</sup> )	0.56 (0.34–0.93)	0.02
<u>Benign prostatic hyperplasia</u>	<u>2.33 (1.16–4.69)</u>	<u>0.02</u>
<u>Metastatic disease</u>	<u>2.31 (1.53–3.50)</u>	<u>&lt;0.01</u>

OR = odds ratio; CI = confidence interval.



**Fig. 1 – Annual rate of rectal injury during radical prostatectomy by surgical approach.**

# Rectourethral Fistula; RUF

## ■ Cause

- Prostatectomy for benign or malignant disease, Cryotherapy, Pelvic radiotherapy, Anorectal surgery, External penetrating trauma, Urethral instrumentation, Locally advanced prostatic or rectal malignancy, Infection, Ruptured prostatic abscess, Inflammatory disease (e.g., Crohn disease)
- RUF after radical retropubic **prostatectomy** (RRP) is low, but **most common cause** of RUF.

## ■ Etiology (prostatectomy setting)

- **Rectal injury** during radical prostatectomy occurs in less than 1% to 2% of patients
- **Risk factor : Prior history of pelvic radiation therapy, Rectal surgery, TURP**

# Rectourethral Fistula; RUF

## ▪ Incidence

- Mayo RRP series, 27 rectal injuries in **2,212 patients**, 26 of 27 recognized intraoperatively and repaired, 6 underwent temporary colostomy, **4 developed RUF.** (McLaren et al, 1993)
- Rectal injuries in 7 of 516 patients undergoing RRP(1.4%) and 1 of 17 patients undergoing radical perineal prostatectomy (Harpster et al, 1995). -> 3 RUF reported.
- Incidence of RUF after **cryosurgical ablation as primary therapy** for localized carcinoma of the prostate is **0.5% to 2%** (Zippe, 1996; Long et al, 2001). Rate of RUF after **cryotherapy as salvage therapy** for prostate cancer is somewhat higher at approximately **3.3%** (Chin et al, 2001)
- RUF after **brachytherapy** for prostate cancer is **0.4%** (Theodorescu et al, 2000)

# Incidence, Risk Factors, Management, and Complications of Rectal Injuries During Radical Prostatectomy

**Table 1 – Overview of selected studies with  $\geq 1000$  cases involving rectal injury (RI) during radical prostatectomy (RP).**

Study	Year	RP technique	RPs (n)	RIs, n (%)	RAFs (n)
Wedmid et al [5]	2011	RARP	6650	11 (0.17)	4
Kheterpal et al [4]	2011	RARP	4400	10 (0.23)	1
Coelho et al [3]	2010	RARP	2500	2 (0.08)	–
Guillonneau et al [8]	2003	LARP	1000	13 (1.30)	1
Lepor et al [6]	2001	ORP	1000	5 (0.50)	0
McLaren et al [7]	1993	ORP	2212	27 (1.22)	4
Borland et al [2]	1992	ORP	1000	10 (1.00)	0
Present study	2016	ORP	19 965	104 (0.52)	24 <sup>a</sup>
		RARP	4111	9 (0.22)	
		SRP	102	7 (6.86)	

RAF = recto-anastomosis fistula; RARP = robot-assisted RP; LARP = laparoscopic RP; ORP = open RP; SRP = salvage RP.

<sup>a</sup> Of the total 24 RAFs, 13 were with and 11 without intraoperative RI.

- **Rectal injury incidence**
  - Open or robotic RP : 113/24076 : 0.47%
  - Salvage RP : 7/102 : 6.86%
- **Overall incidence of RUF after RP < 0.1%**



**Table 2 – Characteristics of patients with and without rectal injury (RI) during radical prostatectomy (RP).**

	RI (n = 120)	No RI (n = 24 058)	p value
Age (yr)	63.2 (58.9–67.6)	63.5 (59.1–68.6)	0.6247
Prostate volume (ml)	43 (31–55)	44 (30–52)	0.8516
Body mass index (kg/m <sup>2</sup> )	26.6 (23.9–28.1)	26.6 (24.4–28.4)	0.9885
<b>D'Amico risk group (%)</b>			<b>&lt;0.001</b>
Low	10.3	33.2	
Intermediate	41.4	47.0	
High	48.3	19.8	
Preoperative PSA (ng/ml)	17.2 (5.7–18.8)	10.1 (4.9–10.7)	0.004
<b>Tumor stage (%)</b>			<b>&lt;0.001</b>
pT2	32.5	66.1	
pT3	64.2	33.4	
pT4	3.3	0.5	
<b>Pathologic GG (%) [11]</b>			<b>&lt;0.001</b>
1	12.5	20.7	
2	41.2	55.8	
3	20.8	16.8	
4	2.5	0.9	
5	22.5	5.8	
<b>Node status pN1 (%)</b>	25.8	8.3	<b>&lt;0.001</b>
<b>PSM (%)</b>	33.3	17.5	<b>&lt;0.001</b>
Robotic RP (%)	9.2	16.8	0.025

PSA = prostate-specific antigen; GG = Gleason grouping; PSM = positive surgical margin.

Data are presented as mean (interquartile range) for continuous variables.

# Rectourethral Fistula; RUF

## ▪ Symptoms

- Fecaluria, hematuria, UTI
- Nausea, vomiting, fever
- Peritonitis, sepsis

## ▪ Diagnosis

- Digital rectal examination
- Cystoscopy, sigmoidoscopy; biopsy for local recur..
- VCUG or RGU; definitive diagnosis
- Upper track imaging; excluding ureteral injury.

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- Despite intra-operative closure of the defect with two or three layers, the risk of recto-anastomosis fistula with the need for further surgical intervention is high for defects >2 cm, salvage RP, or suspicion of rectal infiltration.

## Principles of Urinary Fistula Management

Ensure adequate **nutrition**.

Eliminate **infection**.

Achieve unobstructed urinary **drainage** and/or stenting.

Remove or bypass distal urinary obstruction.

Beware of **malignant** cause of fistula.

## Principles of Surgical Repair of Urinary Fistula

Adequate exposure of the fistula tract with **debridement** of devitalized and ischemic tissue

**Removal** of involved foreign bodies or synthetic materials from region of fistula, if applicable

Careful dissection and/or anatomic separation of the involved organ cavities

**Watertight closure**

Use of well-vascularized, healthy tissue flaps for repair (atraumatic handling of tissue)

**Multiple-layer** closure

**Tension-free**, nonoverlapping suture lines

Adequate urinary tract drainage and/or stenting after repair

Treatment and prevention of infection (appropriate use of antimicrobials)

Maintenance of hemostasis

# Rectourethral Fistula; RUF

## ▪ Management

### ▪ Conservative management;

catheter drainage, bowel rest, intravenous hyperalimentation,,  
In some cases, fecal diversion is necessary

▪ 6 of 8 RUF patients were treated successfully in such a manner. Two patients required a temporary colostomy. (Rassweiler et al, 2003)

▪ Closure with conservative management in 7 of 13 patients with RUF after radical prostatectomy or cystoprostatectomy. (Noldus et al, 1999)

### ▪ Surgical repair

Endoscopic suture, fulguration, fibrin glue, minimally invasive management,  
Open manipulation

# Rectourethral Fistula; RUF

## ▪ Surgical repairs

- **Single or staged repair** : whether or not to perform fecal diversion at all or whether to perform it before or at the time of repair
- **Standard conservative approach : fecal diversion + indwelling urethral catheter**  
-> a trial of spontaneous healing of the fistula without open manipulation.
- **One-stage approach** : surgically induced, small RUFs, not associated with infection, abscess, or poor bowel preparation (Wood and Middleton, 1990; Nunoo-Mensah et al, 2008)
- **Staged repair** : large fistulae, associated with radiation therapy, uncontrolled local or systemic infection, immunocompromised states, or inadequate bowel preparation at the time of definitive repair (Stephenson and Middleton, 1996; Nunoo-Mensah et al, 2008).

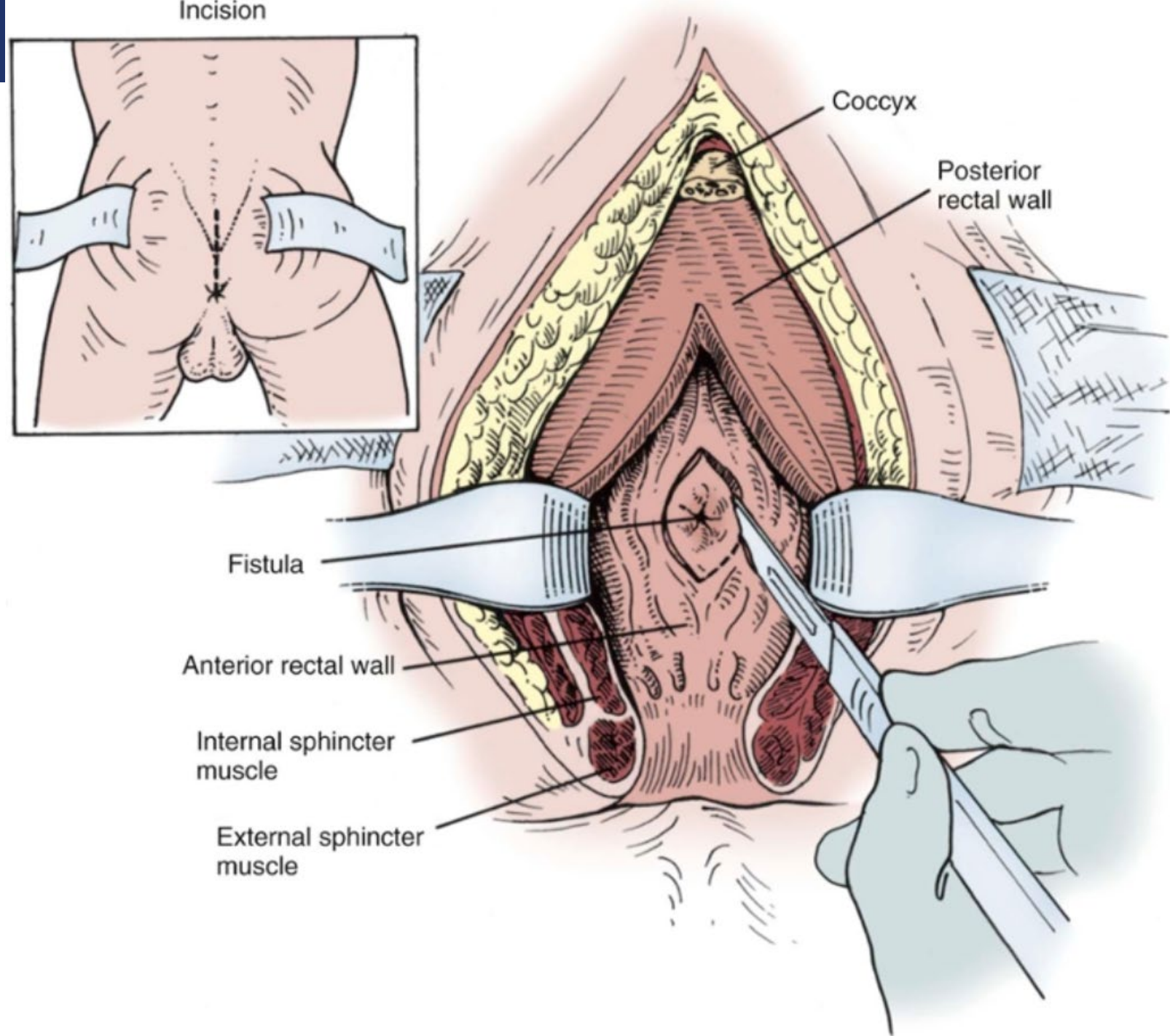
# Rectourethral Fistula; RUF

## ▪ Transrectal approach

- With and without division of the anal sphincter
- **York-Mason procedure** : transrectal, trans-sphincteric approach that has been found to be effective and to have low morbidity
- **Classically, this is a staged repair** with fecal diversion performed before repair of the RUF. However, in patients with small, non-irradiated fistula, a **single-stage approach can be used**, provided that a vigorous bowel preparation and broad-spectrum antibiotics are used
- In the largest series of patients undergoing the York-Mason procedure, a successful repair in 22 of 24 patients was reported. (Renschler et al, 2003)



- Prone, Jackknife position, full-thickness incision through posterior anus and dorsal rectal wall
- Careful anatomic re-approximation of the layers is necessary to avoid devastating complication..



# Rectourethral Fistula; RUF

## ▪ Transrectal approach

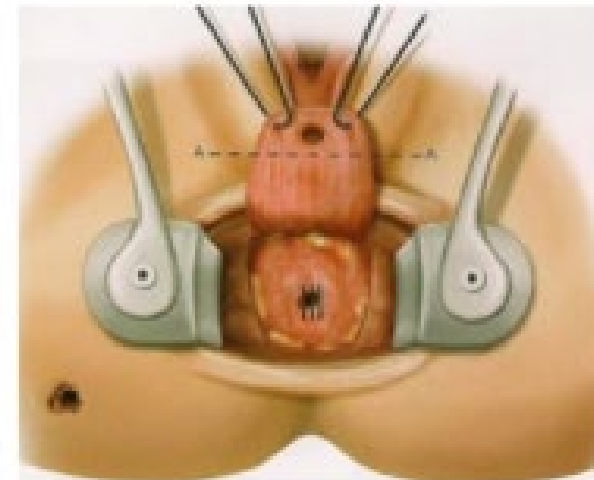


	York-Mason	Kraske
Approach	Transsphincteric prone jackknife	Transsacral prone jackknife
Position		
Procedure	<ul style="list-style-type: none"> <li>(1) Incision from the sacrococcygeal articulation to the anal verge</li> <li>(2) Transection of entire sphincter complex in a layer-by-layer fashion</li> <li>(3) Pairs of marking sutures at the mucocutaneous junction for resuture</li> <li>(4) Midline division of the mucosa of the anus and the full thickness of the posterior rectal wall</li> <li>(5) Sleeve resection or proctotomy</li> </ul>	<ul style="list-style-type: none"> <li>(1) Paracoccygeal incision 2–10 cm from the anal verge</li> <li>(2) Dissect down to and divide the anococcygeal ligament</li> <li>(3) Resection of S4, S5, and coccyx</li> <li>(4) Midline division of the Waldeyer’s fascia</li> <li>(5) Sleeve resection or proctotomy</li> </ul>
Complications	Fecal incontinence, fecal fistula	Fecal fistula

# Rectourethral Fistula; RUF

## ▪ Transanal approach

- Not involve division of the anal sphincter.
- Exposure of the fistula is provided by dilation of the anus and fixed retraction
- The major disadvantage : relatively poor exposure and lack of maneuverability within the operative field.
- Rectal advancement flap
- Latzko procedure



# Rectourethral Fistula; RUF

## ▪ Perineal approach

- Familiar approach for many urologists
- Advantage of local access to a variety of potential interpositional flaps. (Gracilis muscle, pedicled Dartos muscle, penile skin, levator muscle, bladder)

# Gracilis Muscle Interposition for Rectourethral Fistula After Laparoscopic Prostatectomy: A Prospective Evaluation and Long-term Follow-up

**TABLE 1.** Patient epidemiological and clinical baseline data

<i>Age, y</i>	<i>Symptoms</i>	<i>Time with RUF, mo</i>	<i>Digestive diversion</i>	<i>Previous repair attempt (RUF)</i>
60	Pneumaturia Fecaluria	9	Colostomy	Kraske approach
73	Fecaluria Urine per anus	41	Colostomy	Transvesical repair Transanal endoscopic microsurgery ×2 Low anterior rectal resection
61	Transurethral bleeding	10	Colostomy	None
70	Urine per anus Fecaluria	12	None	None
76	Fecaluria	6	None	None
70	Urine per anus Fecaluria	6	Colostomy	None
72	Urine per anus	24	Ileostomy	Left gracilis transposition Rectal primary suture
67	Fecaluria	36	Colostomy	Rectal primary suture
56	Fecaluria	9	Loop colostomy	None

RUF = rectourethral fistula.

## Gracilis Muscle Interposition for Rectourethral Fistula After Laparoscopic Prostatectomy: A Prospective Evaluation and Long-term Follow-up



# Gracilis Muscle Interposition for Rectourethral Fistula After Laparoscopic Prostatectomy: A Prospective Evaluation and Long-term Follow-up

**TABLE 2.** Surgical and postoperative data

<i>Date of surgery (gracilis)</i>	<i>Operation duration, min</i>	<i>Postoperative stay, d</i>	<i>Analgesic requirements</i>	<i>Morbidity</i>
November 3, 2009	240	7	Standard <sup>a</sup>	None
January 13, 2010	160	18	Standard	None
September 10, 2010	180	8	Standard	None
October 6, 2010	190	28	Standard + metamizol	Urine through perineal wound during 15 d
February 9, 2011	180	7	Standard	None
October 14, 2011	210	16	Standard	Urinary infection Limited urine loss through anus
January 23, 2014	245	14	Standard	Gastritis
October 30, 2015	210	4	Standard	None
February 18, 2016	190	7	Standard	None

<sup>a</sup>Standard analgesia includes paracetamol + dexketoprofen 3 times per day.

# Rectourethral Fistula; RUF

## ▪ Transabdominal approach

- Limited success
- Principal advantage : availability of greater omentum for an interpositional flap.
- Potential disadvantage : morbidity, prolonged postop convalescence, poor exposure of OP field.



# Rectourethral Fistula; RUF

## ▪ Endoscopic treatment

- Minimally invasive Over-the-scope clip (OTSC) method
- For small fistula

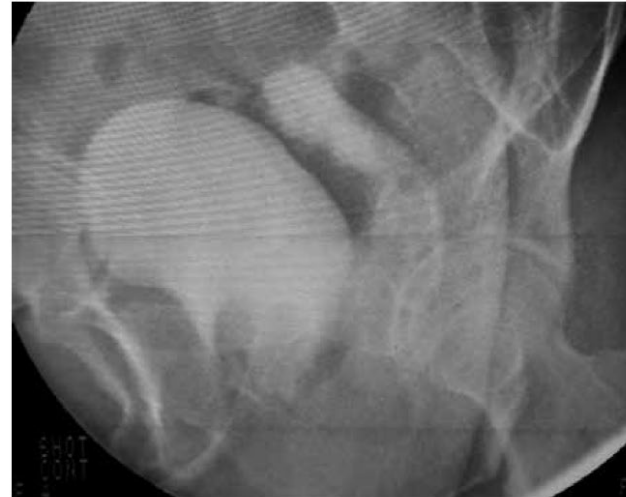


Photo 1. Cystography with vesicorectal fistula

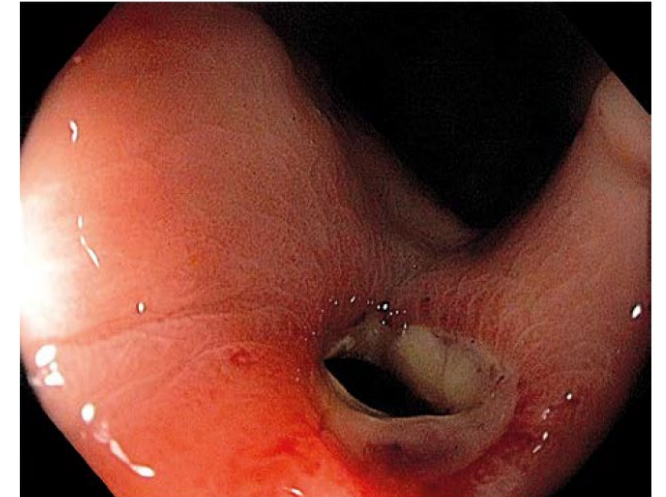


Photo 2. Rectoscopy with opening of the vesicorectal fistula

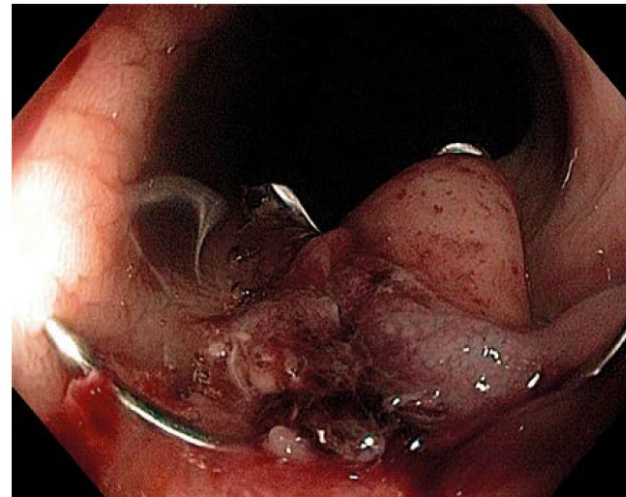
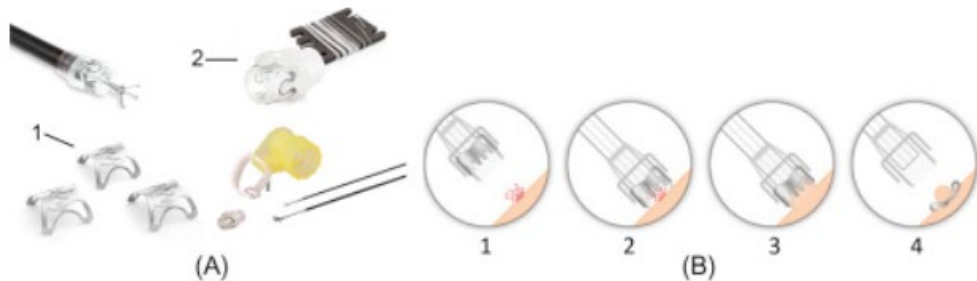


Photo 3. The OTSC placement over the fistula



Photo 4. Cystography with healed fistula



- Although rare (0.5%), RI results in considerable perioperative morbidity
- RUF after radical retropubic **prostatectomy** (RRP) is low, but **most common cause** of RUF
- Lower surgeon volume, prior radiation or rectal surgery, BPH, and more aggressive PCa were independently associated with RI during RP, while obesity, a robotic approach, and high-volume hospitals were independently associated with a lower risk.
- Adequate nutrition, unobstructed urinary drainage is necessary for rectal injury.
- Diverting colostomy seems to be unnecessary in patients with non-aggravating factors, and therefore should only be recommended in cases with infiltration of the rectum, prior prostate surgery, large RI, or salvage RP, but not as a standard of care in all patients with intraoperative RI.

**Thank you for your attention**