



Unità Operativa Complessa di Nefrologia

Scuola di Specializzazione in Nefrologia

Fondazione Policlinico Universitario A.Gemelli IRCCS

Roma

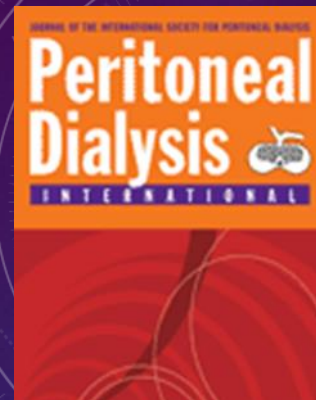
Tipologie e tecniche di posizionamento del catetere peritoneale

Antonio Sturniolo

RATIONAL CHOICE OF PERITONEAL DIALYSIS CATHETER

Roberto Dell'Aquila, Claudio Ronco ed al.

Department of Nephrology, Dialysis, and Transplantation,
St. Bortolo Hospital, Vicenza, Italy



- Catheter-related problems are often the cause of permanent transfer to hemodialysis in up to 20% of peritoneal dialysis patients
- The peritoneal catheter is the major obstacle to widespread use of PD.
- Overcoming catheter-related problems means giving a real chance to development of the peritoneal technique.

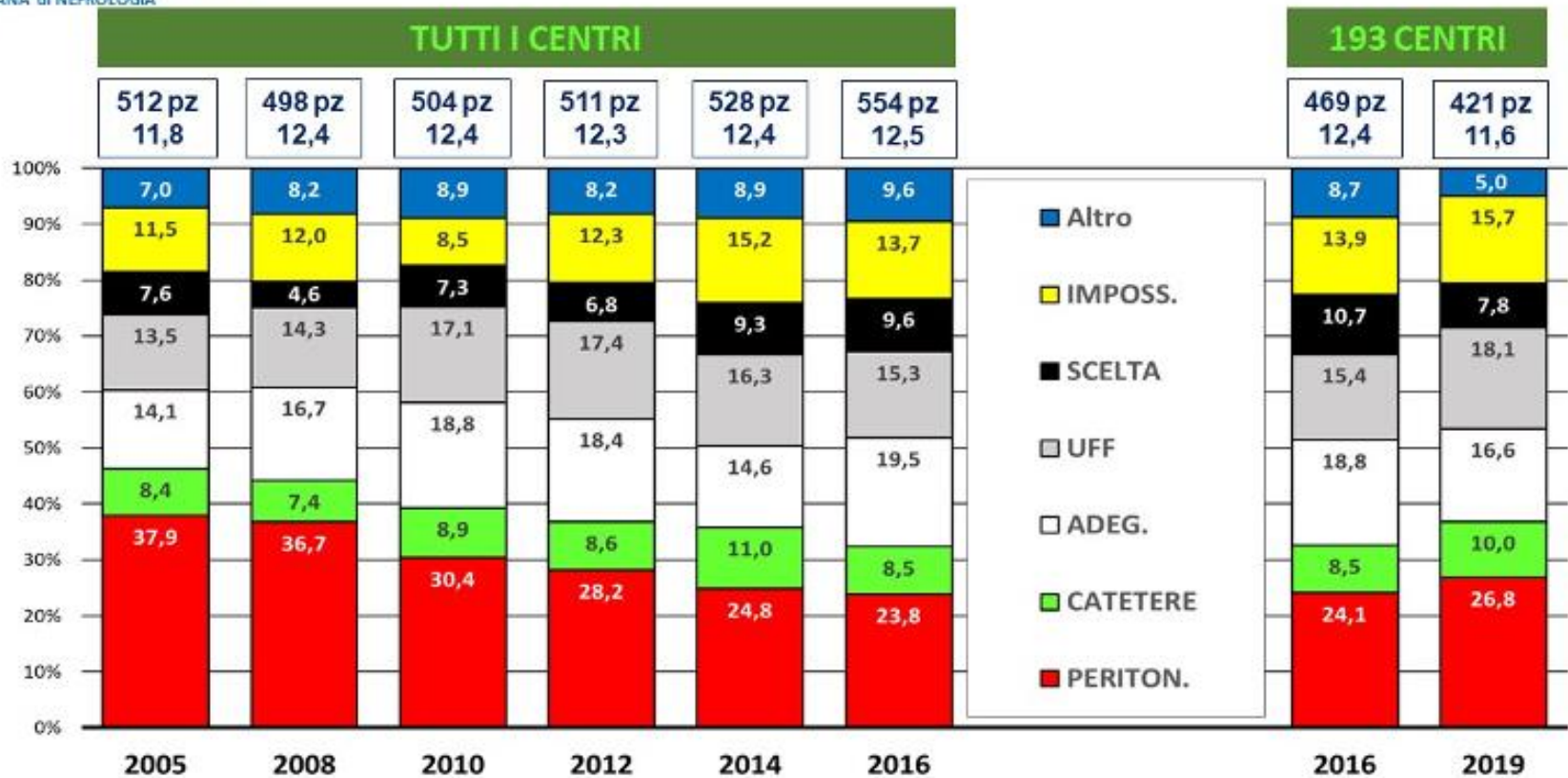


GRUPPO di PROGETTO di DIALISI PERITONEALE
SOCIETA' ITALIANA di NEFROLOGIA

CENSIMENTO GPDP 2019

CAUSE DI DROP OUT IN HD NEGLI ANNI

DISTRIBUZIONE PERCENTUALE DELLE CAUSE DI DROP OUT



Quale catetere?

Tab. 1 STORIA DELL'EVOLUZIONE DEI CATETERI

- **1923 Ganter:** Trocar metallico
- **1925 Rosenak:** Cannula di vetro per drenaggio chirurgico con fori laterali
- **1927 Engel:** Catetere di vetro con apertura a fungo in peritoneo
- **1946 Reid:** Catetere di Foley
- **1946 Fine:** 1° tunnel sottocutaneo e catetere di gomma con apertura a fungo in peritoneo
- **1949 Derot-Legrain:** 1° CP in polivinile (semirigido)
- **1959 Maxwell:** 1° CP in nylon (semirigido)
- **1959 Doolan:** CP in polivinile ondulato in superficie (semirigido)
- **1962 Merrill/Boen:** Condotto/Bottone percutaneo di plastica/teflon attraverso cui s'inseriva il CP
- **1963 Palmer-Quinton:** 1° CP in silicone, prototipo degli attuali CP coiled
- **1965 Weston-Roberts:** 1° CP in nylon o polivinile a stiletto
- **1967 Deane:** Protesi flessibile in plastica inserita a fine dialisi al posto del CP
- **1968 Tenckhoff-Schechter:** 1° CP a permanenza in silastic
- **1975 Goldberg:** CP in silastic munito di palloncino gonfiabile con fisiologica

- **1975 Gotloib:** Protesi sottocutanea in teflon ad imbuto
- **1976 Oreopoulos:** CP TWH in silastic
- **1977 Stephen:** Catetere sottocutaneo in silastic-dacron con spirale metallica
- **1980 Ash:** Column disc Lifecath in silicone
- **1981 Valli:** CP con piombatura e palloncino rigido fenestrato in silastic
- **1985 Twardowski:** 1° CP "Swan-Neck" in silastic
- **1988 Cruz:** CP "Ball Handle" in poliestere
- **1992 Di Paolo:** CP autolocante (SEPOC) in silastic con protesi di tungsteno
- **1992 Twardowski:** CP "Swan-Neck" Missouri
- **1993 Ash:** CP "T-fluted" in silastic
- **1996 Moncrief-Popovich:** CP "Swan-Neck" con cuffia sottocutanea di 2.5 cm
- **1996 Twardowski:** CP "Swan-Neck" presternale

I cateteri peritoneali più usati in Italia

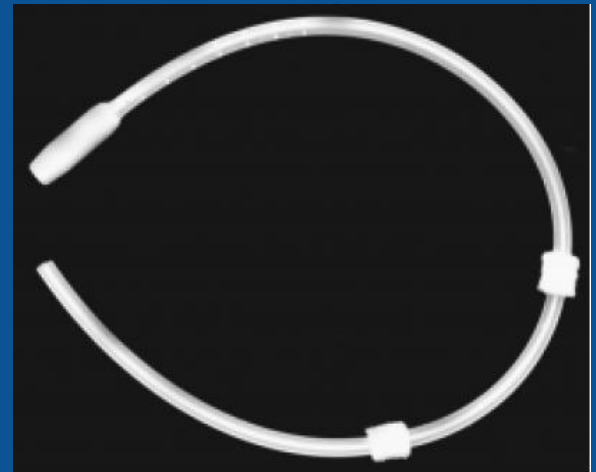


Figure 4 — Di Paolo “self locating” peritoneal dialysis catheter.

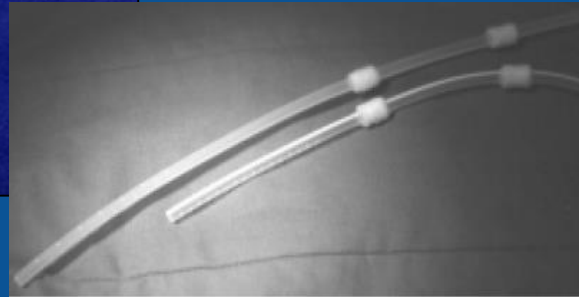
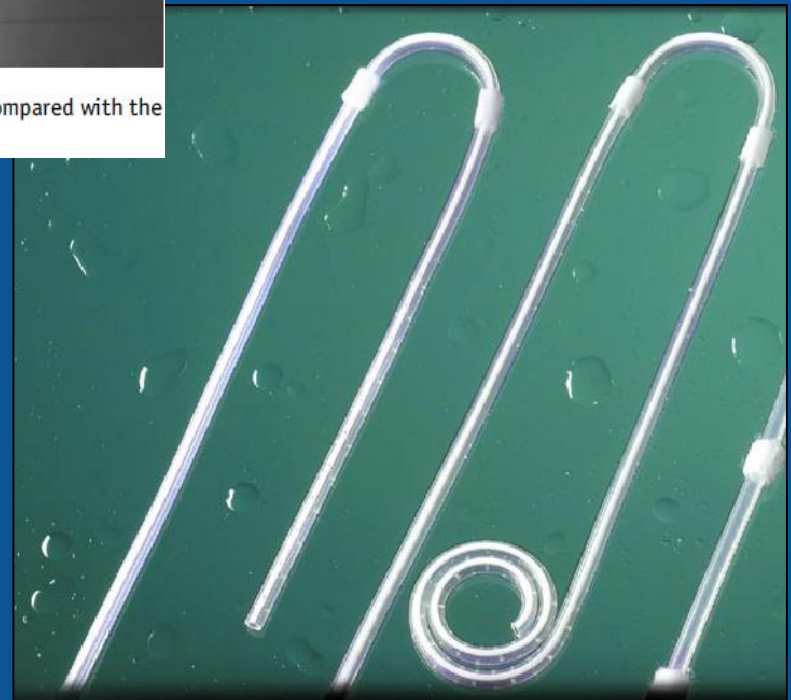
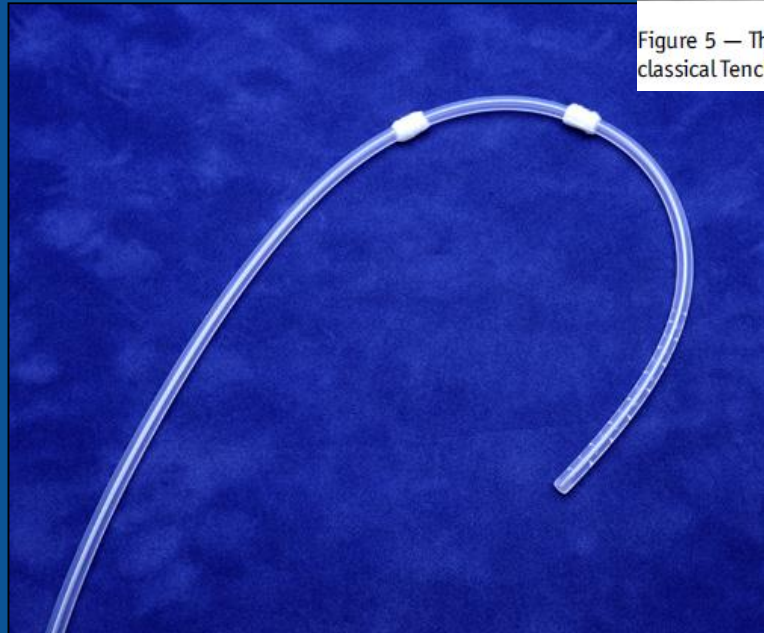


Figure 5 — The Vicenza “short” catheter compared with the classical Tenckhoff.





Guideline 5.2: Facilities for PD Catheter Insertion (2C):

- We suggest that no particular catheter type has been proven to be better than another.

CLINICAL PRACTICE GUIDELINES FOR PERITONEAL ACCESS

Ana Figueiredo,¹ Bak-Leong Goh,² Sarah Jenkins,³ David W. Johnson,⁴ Robert Mactier,⁵
Santhanam Ramalakshmi,⁶ Badri Shrestha,³ Dirk Struijk,⁷ and Martin Wilkie³

Faculdade de Enfermagem, Nutrição e Fisioterapia,¹ Pontifícia Universidade Católica do Rio Grande do Sul, Brazil; Department of Nephrology,² Serdang Hospital, Jalan Puchong, Kajang, Selangor, Malaysia; Sheffield Kidney Institute,³ Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield, United Kingdom; Nephrology,⁴ Princess Alexandra Hospital, Woolloongabba, Brisbane, Queensland, Australia; Renal Services,⁵ Glasgow Royal Infirmary, Glasgow, Scotland, United Kingdom; Nephrology,⁶ Sri Ramachandra University, Chennai, India; Dialysis Unit,⁷ Dianet Dialysis Centers and Academic Medical Center, University of Amsterdam, Amsterdam, The Netherlands

Chi deve posizionare il
catetere peritoneale?

Who should place peritoneal dialysis catheters?

Crabtree JH.

- Although there may be nothing particularly difficult about PD catheter implantation, there are a number of critical details that influence the outcome of the procedure.
- If, as we have seen, the majority of PD centers have only 5 – 10 new starts per year and the learning curve requires 20 – 40 cases, how can any provider hope to develop expertise in catheter placement?
- Under these circumstances, operators find themselves continuously relearning the procedure each time it is performed.

Who should place peritoneal dialysis catheters?

Crabtree JH.

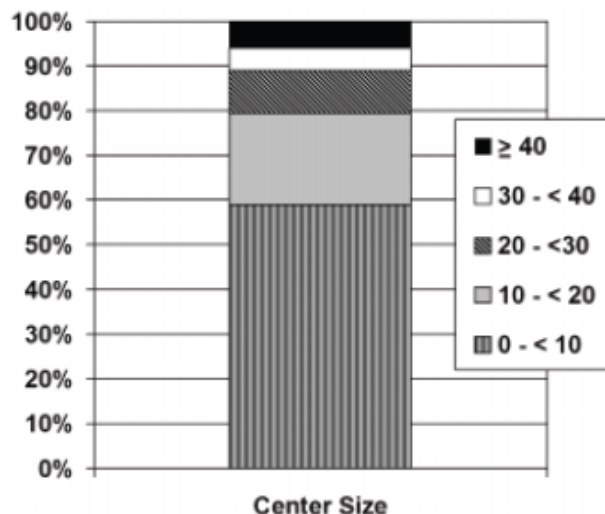


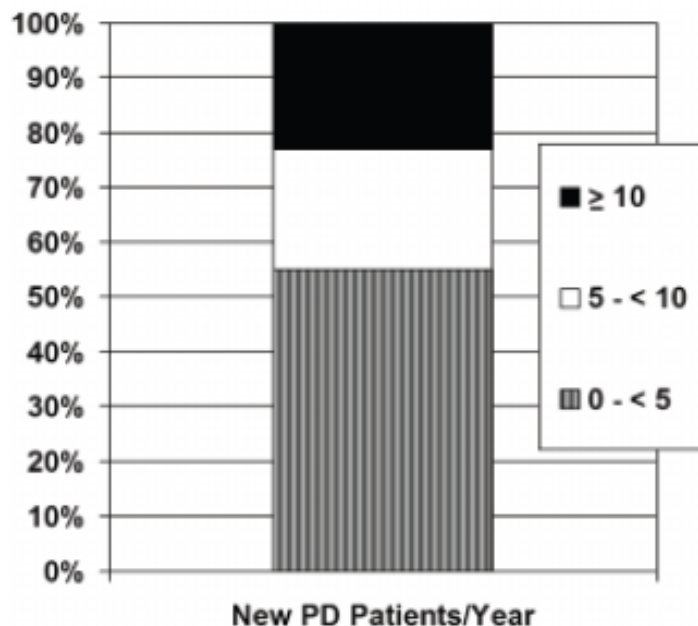
Figure 1 — Shown is the distribution of peritoneal dialysis centers by center size. The figure was modified from Mujais S, Story K. Peritoneal dialysis in the US: evaluation of outcomes in contemporary cohorts. *Kidney Int Suppl* 2006; 103:S21-6.

These data indicate that

- the majority of **PD centers are small** and infer that most providers, regardless of specialty, **have limited experience in PD catheter placement.**

Who should place peritoneal dialysis catheters?

[Crabtree JH.](#)



small center sizes,
with few annual
new starts

Figure 2 — Graphed is the distribution of peritoneal dialysis centers by annual number of new starts on peritoneal dialysis. The data were taken from Mujais S, Story K. Peritoneal dialysis in the US: evaluation of outcomes in contemporary cohorts. *Kidney Int Suppl* 2006; 103:S21-6.

Who should place peritoneal dialysis catheters?

Crabtree JH.

Distribution of Medical Specialties Performing Peritoneal Catheter Insertion Procedures in 2007^a

| Medical specialty | Conventional (CPT 49421) ^b [n (%)] | Laparoscopic (CPT 49324) ^c [n (%)] | All [n (%)] |
|-------------------|---|---|----------------|
| Surgery | 4740 (68.6) | 2101 (86.5) | 6841 (73.2) |
| Vascular surgery | 1131 (16.4) | 174 (7.2) | 1305 (14) |
| Radiology | 492 (7.1) | 1 (0) | 493 (5.3) |
| Nephrology | 191 (2.8) | 25 (1.0) | 216 (2.3) |
| Other | 357 (5.2) | 128 (5.3) | 485 (5.2) |
| Total | 6911 (100) | 2429 (100) | 9340 (100) |

Importance of peritoneal dialysis catheter insertion by nephrologists: practice makes perfect

Philip Kam-tao Li and Kai Ming Chow

Division of Nephrology, Department of Medicine and Therapeutics, Prince of Wales Hospital, Chinese University of Hong Kong, Hong Kong, Hong Kong



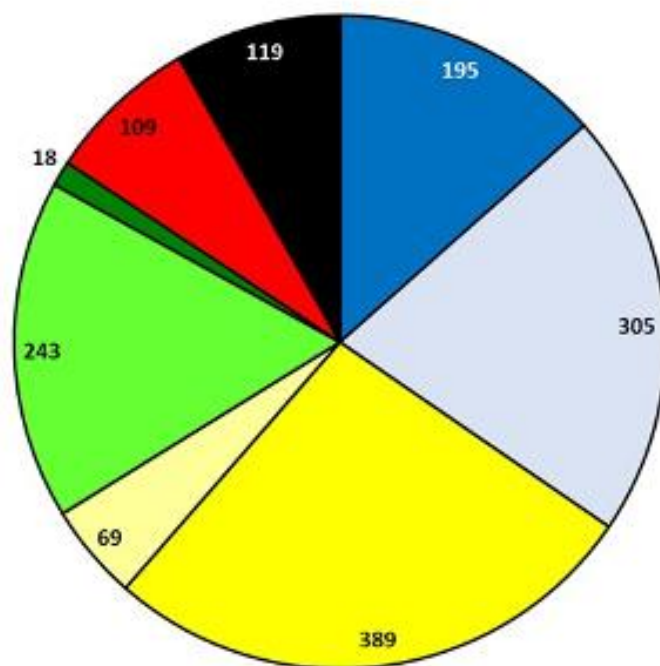
- The success of catheter insertion by committed and **well-trained nephrologists** is not surprising because it effectively reflects the dogma of ‘**practice makes perfect**’.



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CENSIMENTO GPDP 2019

CATETERE PERITONEALE – 180 CENTRI – 1.447 CATETERI



| TECN. | CHI | ANESTESIA |
|-------|-----|-----------|
|-------|-----|-----------|

■ C - C - AG

□ C - C - AL

■ C - CN - AL

□ C - CN - AG

■ C - N - AL

■ S - N - AL

■ VIDEOLAPAROSCOPIA

■ ALTRO / NON SPEC. / NON INV.

14,7%

23,0%

29,3%

5,2%

18,3%

1,4%

8,2%

TECN.
CHI
ANESTESIA

C = Chirurgica
C = Chirurgo
AG = generale

S = Semichirurgica
N = Nefrologo
AL = locale

CN = Chirurgo e Nefrologo insieme

Peritoneal Dialysis Catheter Insertion Strategies and Maintenance Of Catheter Function

Nasim Shahbazi, MD,† and Brendan B. McCormick, MD*†‡*

*Division of Nephrology, University of Ottawa, Ottawa, Ontario, Canada.

†Department of Medicine, University of Ottawa, Ottawa, Ontario, Canada.

‡Kidney Research Centre, Ottawa, Ontario, Canada



- There does not appear to be one single insertion technique or catheter that is universally associated with superior mechanical outcomes
- the ***expertise and interest of the operator*** appears to be the most important factor in determining the success of the procedure.

Peritoneal Dialysis Catheter Insertion Strategies and Maintenance Of Catheter Function

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- There has been **increased interest** in both bedside and fluoroscopic-guided percutaneous PD catheter insertion **as a result of excessive wait time for surgical insertion**
- Outcomes between bedside percutaneous, fluoroscopic, and surgical insertion strategies is difficult because of the paucity of randomized controlled trials for surgical insertion

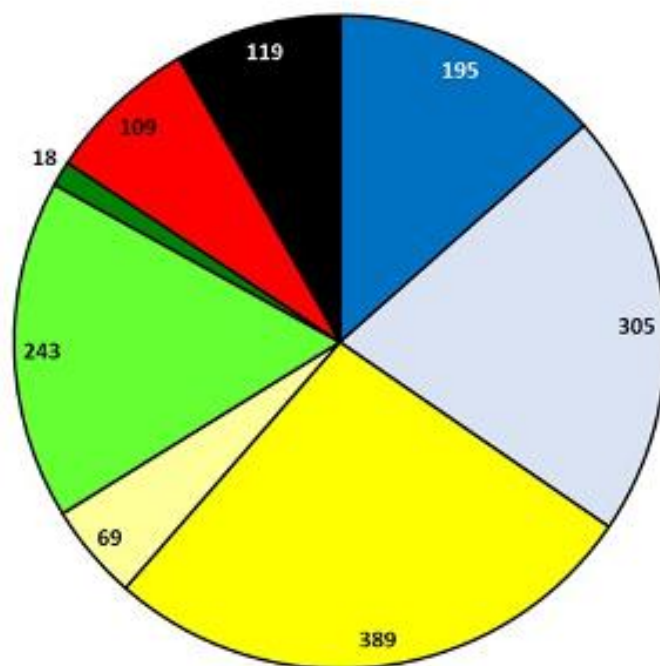
Tecniche di inserzione



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Con quale tecnica?

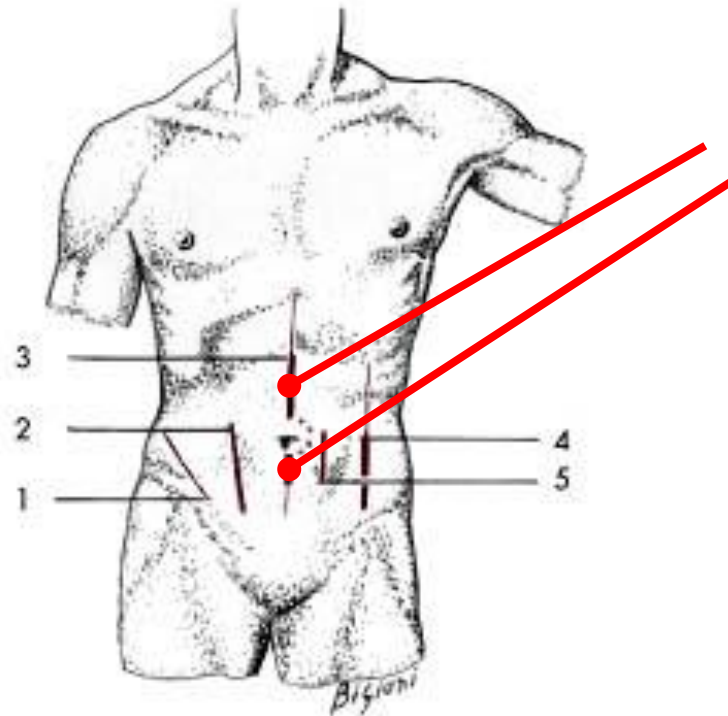
- Percutanea/semichirurgica
- Laparoscopica
- Chirurgica (a cielo aperto)

Tecnica Percutanea

Punti di inserimento catetere peritoneale

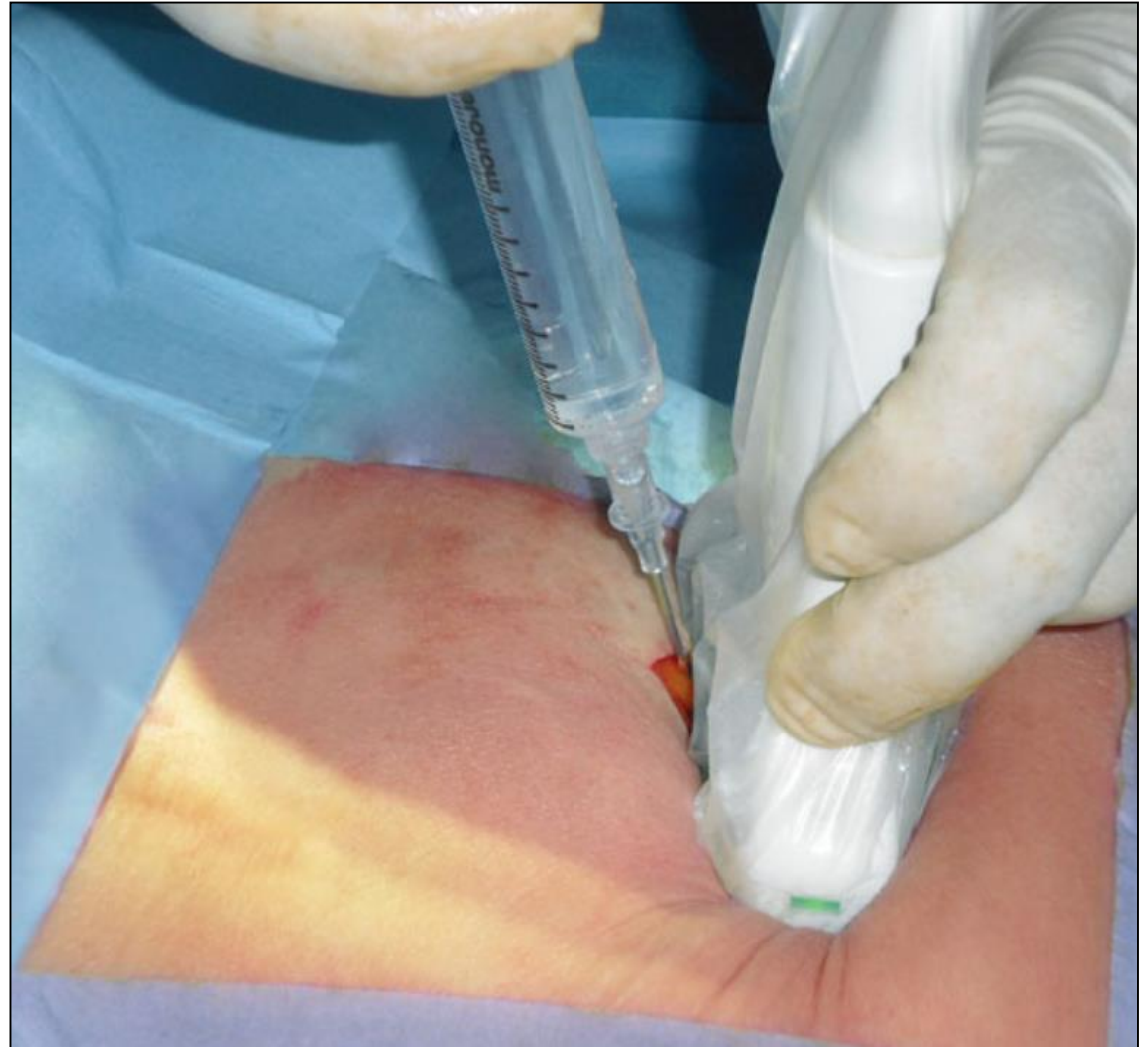
FIGURA 5 •

Principali incisioni della parete addominale anteriore utilizzate per accedere alla cavità peritoneale

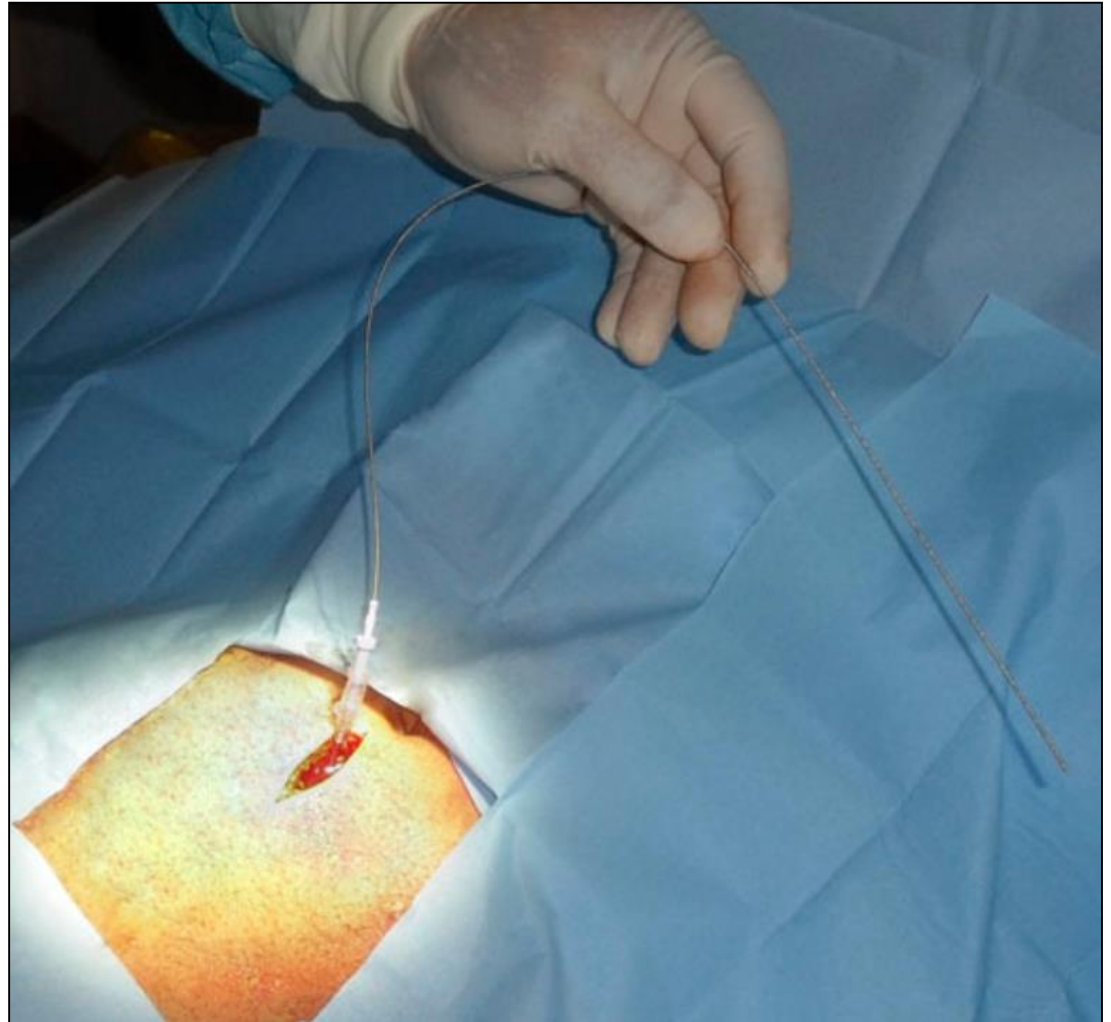


1 = incisione iliaca, detta di Roux, per gli ascessi appendicolari; 2 = incisione sul margine laterale del retto, o para-rettale, detta di Jalaguier; 3 = laparotomia mediale sopra- e sotto-ombelicale; 4 = laparotomia laterale; 5 = via trans-rettale, utilizzata per l'impianto stabile dei cateteri di Tenckhoff.

La procedura eco-guidata permette di ridurre il rischio di puntura arteriosa o di perforazione intestinale legate alla manovra cieca.



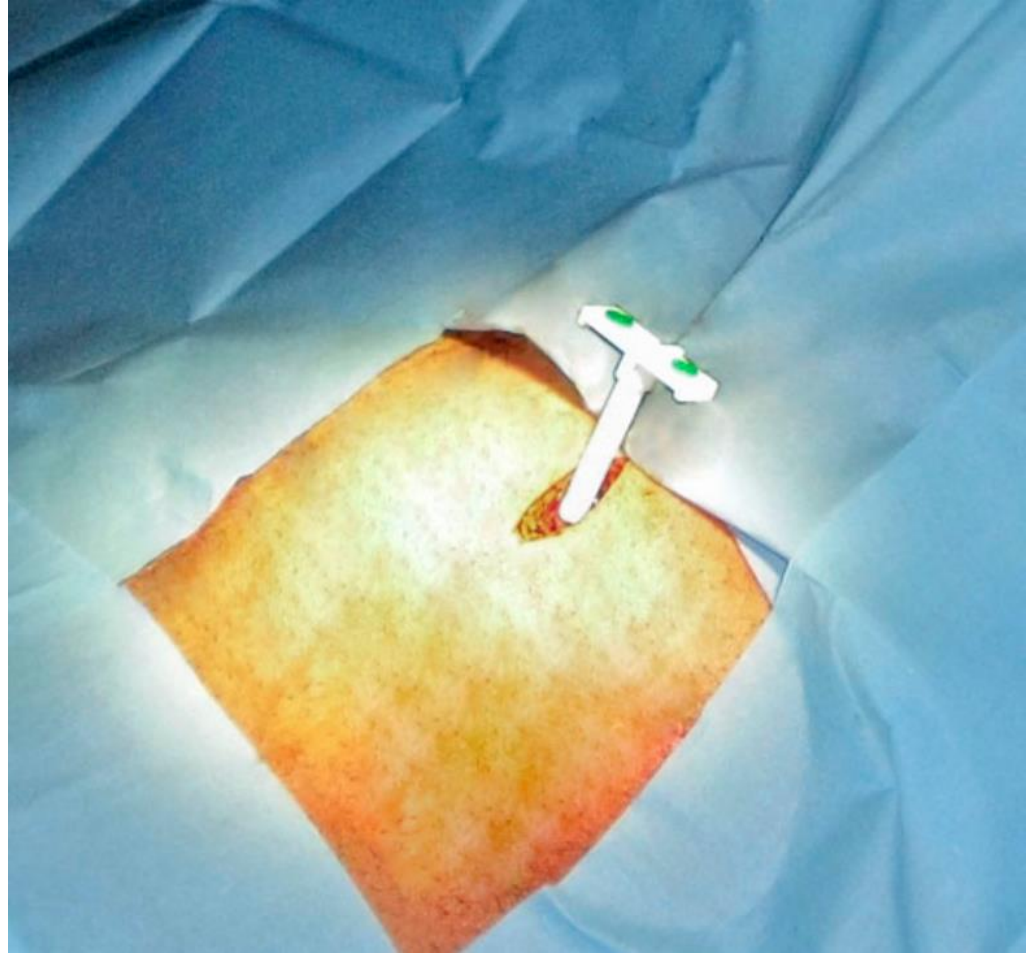
- Viene introdotta, nel lume dell'ago, una guida metallica flessibile, poi si estrae l'ago lasciando in sede la guida.



- Un dilatatore e l'introduttore vengono quindi fatti avanzare nella cavità addominale seguendo la guida, previa piccola incisione con bisturi,



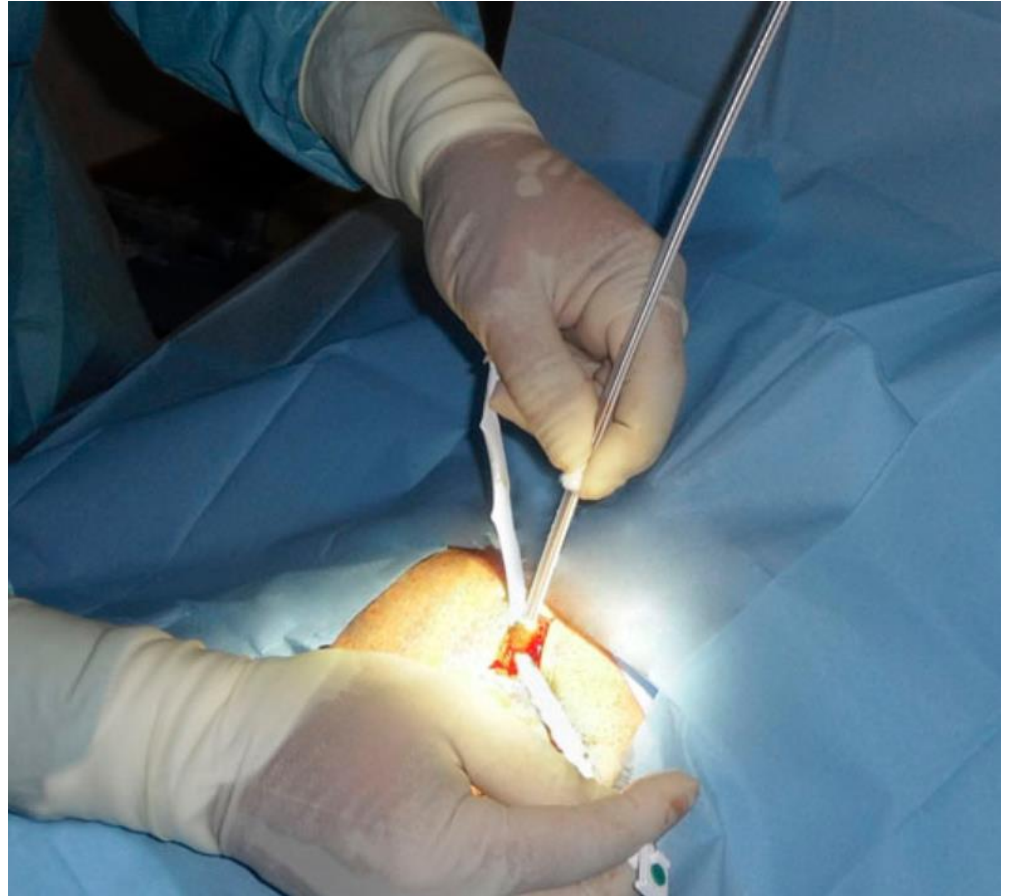
si rimuovono il
dilatatore e la
guida lasciando
in sede
l'introduttore a
guaina



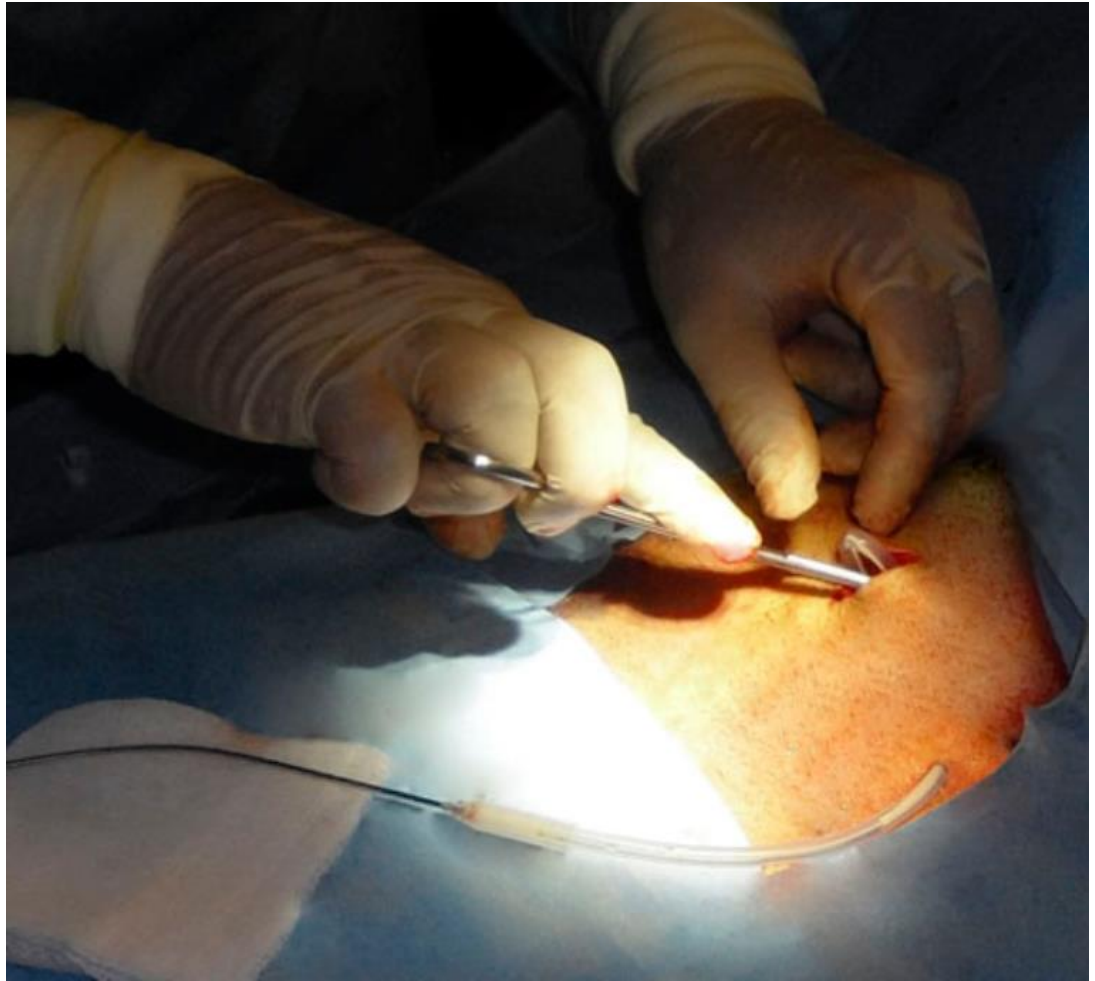
il catetere peritoneale, armato con un mandrino metallico, viene posizionato in addome attraverso l'introduttore. Va posta particolare cura che il catetere trovi la giusta collocazione verso la cavità del Douglas in basso e verso sinistra come per qualsiasi altro tipo di posizionamento



A questo punto si possono rimuovere il mandrino e l'introduttore "peel-away" con la separazione delle sue due parti lungo la linea di strappo



Con un
tunnellizzatore si
configura il
percorso
sottocutaneo del
catetere con
direzione latero-
inferiore curando il
corretto
posizionamento
della cuffia
esterna a non
meno di 2 cm
dall'exit-site



BEST PRACTICES CONSENSUS PROTOCOL FOR PERITONEAL DIALYSIS CATHETER PLACEMENT BY INTERVENTIONAL RADIOLOGISTS

Ahmed K. Abdel-Aal,¹ Paul Dybbro,² Peter Hathaway,³ Steven Guest,⁴ Michael Neuwirth,⁵
and Venkat Krishnamurthy⁶

Department of Radiology,¹ University of Alabama at Birmingham, Birmingham, Alabama; Interventional Radiology,² Kaiser Permanente Hayward, Hayward, California; Interventional Radiology,³ Utah Vascular Clinic, Salt Lake City, Utah; Baxter Healthcare Corporation,⁴ Deerfield, Illinois; Vascular and Interventional Radiology, Carle Foundation Hospital and Carle Physician Group,⁵ Urbana, Illinois; and Radiology Services,⁶ VA Ann Arbor Health System, Ann Arbor, Michigan, USA



Figure 3 — A 21-gauge micropuncture needle is advanced in a caudal direction toward the pelvis at a 45-degree angle from the skin surface under ultrasonographic guidance.

The authors submit these consensus-proposed best demonstrated practices for placement of PD catheters by interventional radiologists under ultrasonographic and fluoroscopic guidance.

Tecnica laparoscopica

Prospective Randomized Study for Comparison of Open Surgery with Laparoscopic-Assisted Placement of Tenckhoff Peritoneal Dialysis Catheter — A Single Center Experience and Literature Review

Shyh-Chuan Jwo, M.D.,*,¹ Kuo-Su Chen, M.D.,† Chin-Chan Lee, M.D,† and Huang-Yang Chen, M.D.‡

| | Draganic, 1998 [22] | Wright, 1999 [23] | Tsimoyiannis, 2000 [26] | Crabtree, 2000 [27] |
|----------------------|------------------------|-------------------------|----------------------------|--------------------------|
| Design | R | PR | PR | PNR |
| No. procedure | 30 OP/30 L | 24 OP/21 L | 25 OP/25 L ^a | 63 OP/150 L ^b |
| Operative time (min) | 57/41* | 14.3/21.9* | 22/29* | — |
| Postoperative pain | OP > L* | OP = L | — | OP > L* |
| Wound length (cm) | — | — | — | — |
| Hospital stay (d) | — | 2.4/3.1 | — | — |
| Operative cost | — | — | — | — |
| Major complications | Overall | Early Late ^g | Overall | Overall |
| a. Ob (%) | 10.0/3.3 | 0.0/0.0 0.0/0.0 | 20.0/0.0* | 17.5/6.7* |
| b. D leak (%) | 0.0/3.3 | 0.0/9.5 0.0/0.0 | 32.0/0.0* | 1.6/1.3 |
| c. E-s infect (%) | 16.7/16.7 | 16.7/9.5 16.7/28.6 | — | — |
| d. Peritonitis (%) | 23.3/16.7 | 4.2/14.3 45.8/28.6 | 20.0/12.0 | — |
| Overall comp rate | OP = L [‡] | OP = L | — | — |
| Mean FU (m) | 16.2/9.8 | — | — | 19.6/15.2 |
| Catheter longevity | OP = L | OP = L | — | OP < L* |
| Comments | Equivalent | Equivalent | Positive | Positive |

Prospective Randomized Study for Comparison of Open Surgery with Laparoscopic-Assisted Placement of Tenckhoff Peritoneal Dialysis Catheter — A Single Center Experience and Literature Review

Shyh-Chuan Jwo, M.D.,^{*,1} Kuo-Su Chen, M.D.,[†] Chin-Chan Lee, M.D.,[†] and Huang-Yang Chen, M.D.[‡]

**Division of General Surgery, Chang Gung Memorial Hospital, Keelung, and Chang Gung University, Tao-Yuan, Taiwan, ROC; †Division of Nephrology, Chang Gung Memorial Hospital, Keelung, Taiwan, ROC; and ‡Division of General Surgery, Chang Gung Memorial Hospital, Keelung, Taiwan, Republic of China*

| | Daschner, 2002 [24] | Batey, 2002 [25] | Ogunc, 2003 [28] | Crabtree, 2005 [29] | Present study |
|----------------------|-------------------------|---------------------------|---|---------------------|--|
| Design | PNR | R | PNR | PNR | PR |
| No. procedure | 23 OP/25 L ^c | 12 OP/ 14 L ^{d†} | 21 OP ^{b†} /21 L ^{e†} | 63 OP/78 L/200 AL | 40 OP [†] /37 L ^{ft} |
| Operative time (min) | – | 55.7/41.7* | 30.9/45.4* | – | 46.7/68.3* |
| Postoperative pain | – | OP > L* | OP > L* | – | OP = L |
| Wound length (cm) | – | – | – | – | 2.3/1.7* |
| Hospital stay (d) | – | 1.5/0.14* | 3.1/1.1* | – | OP = L |
| Operative cost | – | – | – | – | OP < L* |
| Major complications | Early ^h | Overall | Early Late ^h | Overall | Early Late ^h |
| a. Ob (%) | 8.7/8.0 | 8.3/21.4 | 23.8/0.0* –/0.0 | 17.5/12.8/0.5* | 15.0/2.7 2.5/8.1 |
| b. D leak (%) | 21.7/8.0 | 41.7/7.1 | 0.0/0.0 0.0/4.7 | 1.6/1.3/2.0 | 15.0/18.9 2.5/2.7 |
| c. E-s infect (%) | – | – | 38/19* 9.5/4.7 | – | 0.0/0.0 12.5/16.2 |
| d. Peritonitis (%) | – | – | 38/9.5* 14.2/4.7* | – | 0.0/0.0 15.0/27.0 |
| Overall comp rate | OP > L | OP = L | OP > L* | OP = L > AL* | OP = L [§] |
| Mean FU (m) | – | – | – | 23.3/26.9/21 | 16.2/16.4 |
| Catheter longevity | – | – | OP < L* | – | OP = L |
| Comments | Equivalent | Equivalent | Positive | Positive | Equivalent |

Prospective Randomized Study for Comparison of Open Surgery with Laparoscopic-Assisted Placement of Tenckhoff Peritoneal Dialysis Catheter—A Single Center Experience and Literature Review

Shyh-Chuan Jwo, M.D.,^{*,1} Kuo-Su Chen, M.D.,[†] Chin-Chan Lee, M.D,[†] and Huang-Yang Chen, M.D.[‡]

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Conclusions

- Laparoscopic assisted percutaneous puncture exhibited no superiority to open surgery.
- As a matter of fact, open surgery's shorter operative time and reduced equipment requirement can increase cost-effectiveness.
- Therefore, conventional open surgery is recommended for most patients with primary catheter placement.

Tecnica laparoscopica

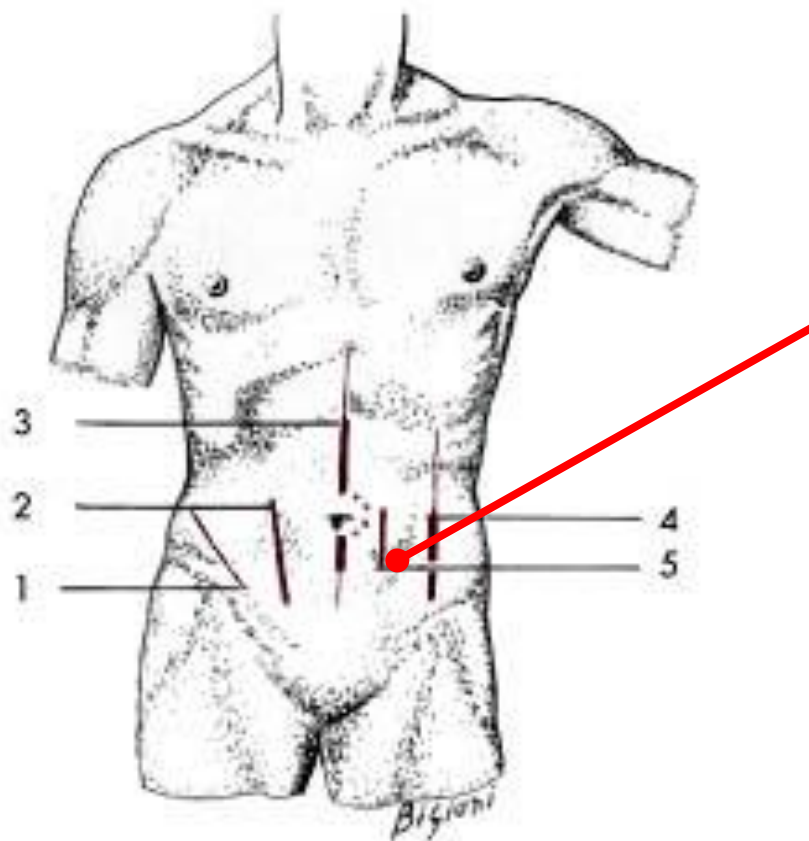
Indicazioni

- Nel paziente pluri-operato
- Revisione nei malfunzionamenti (wrapping omentale)
- Effettuazione di altri interventi chirurgici in contemporanea al posizionamento del catetere (colecistectomia, appendicectomia, ecc.).

Tecnica chirurgica (open)

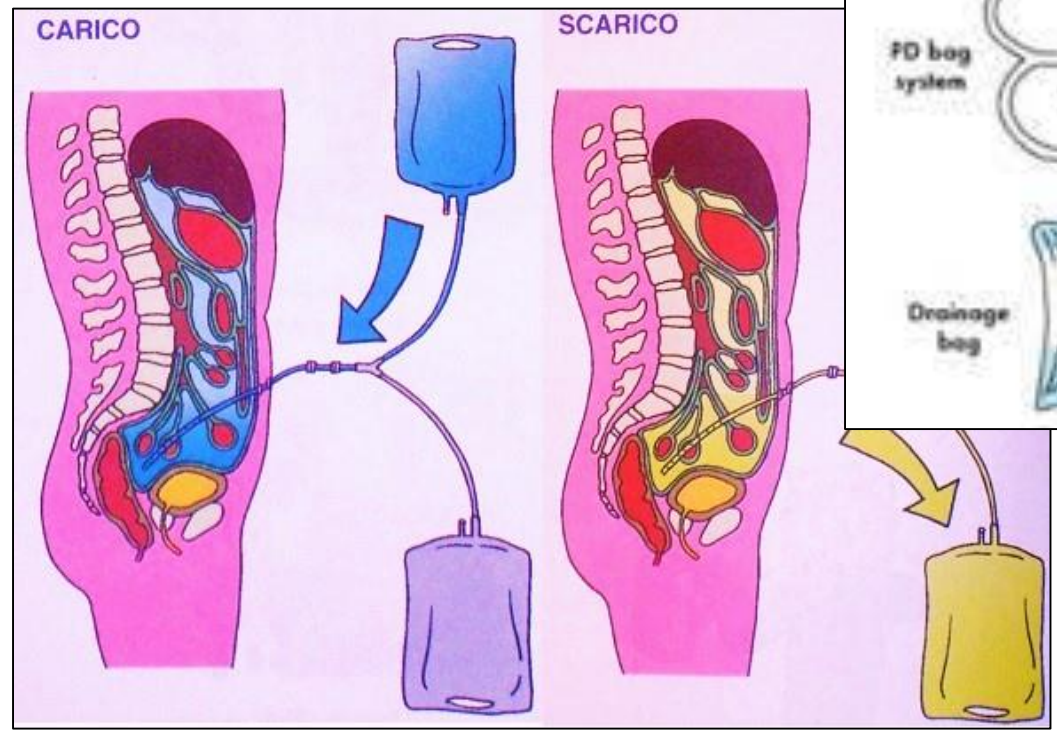
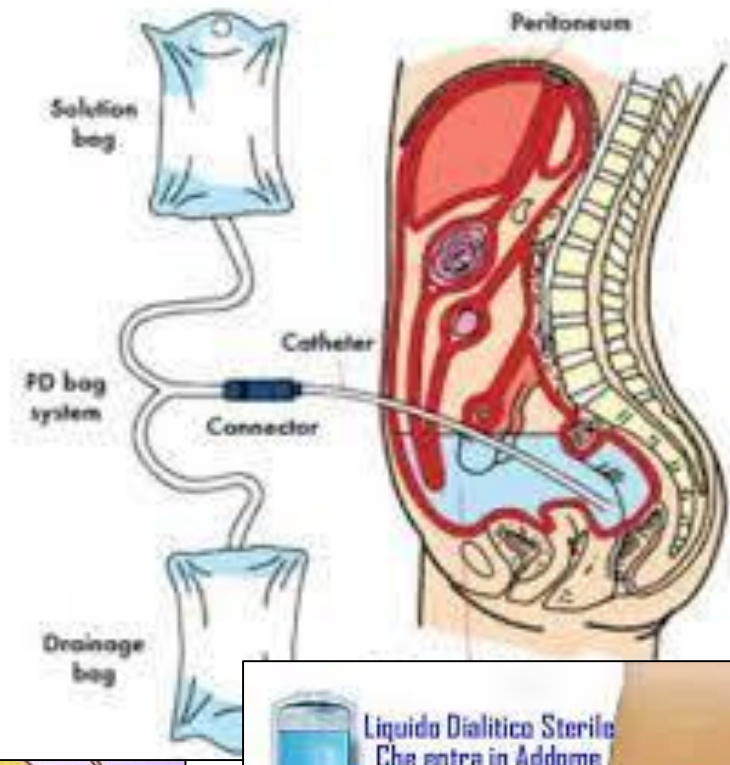
FIGURA 5 •

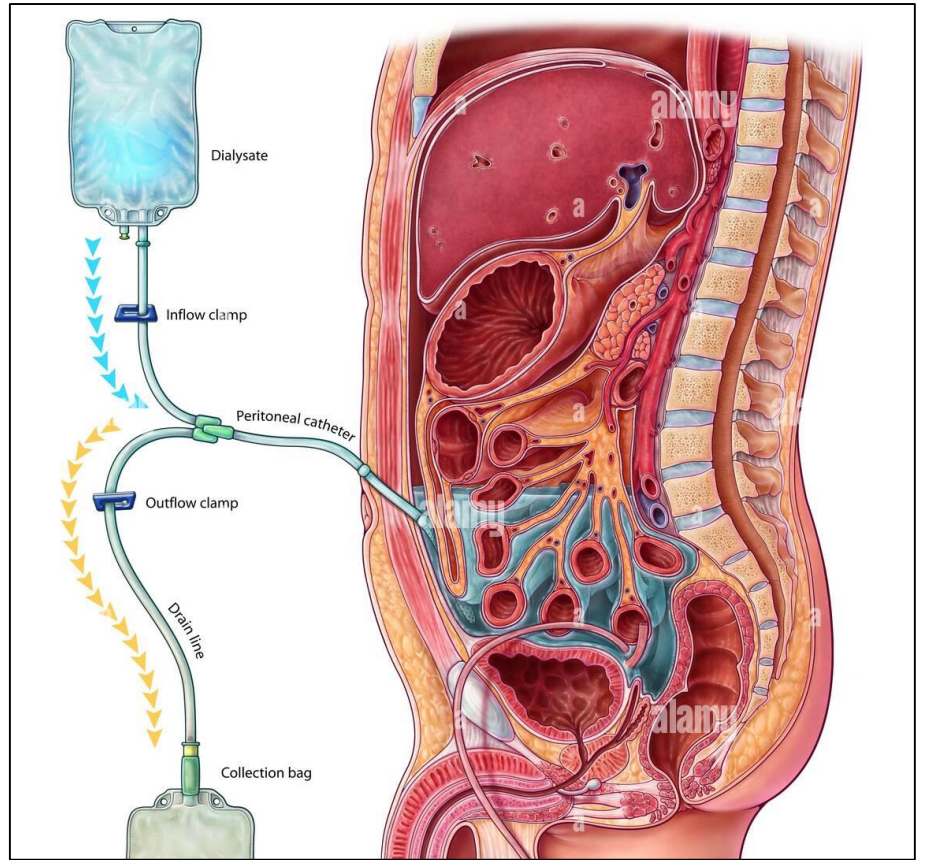
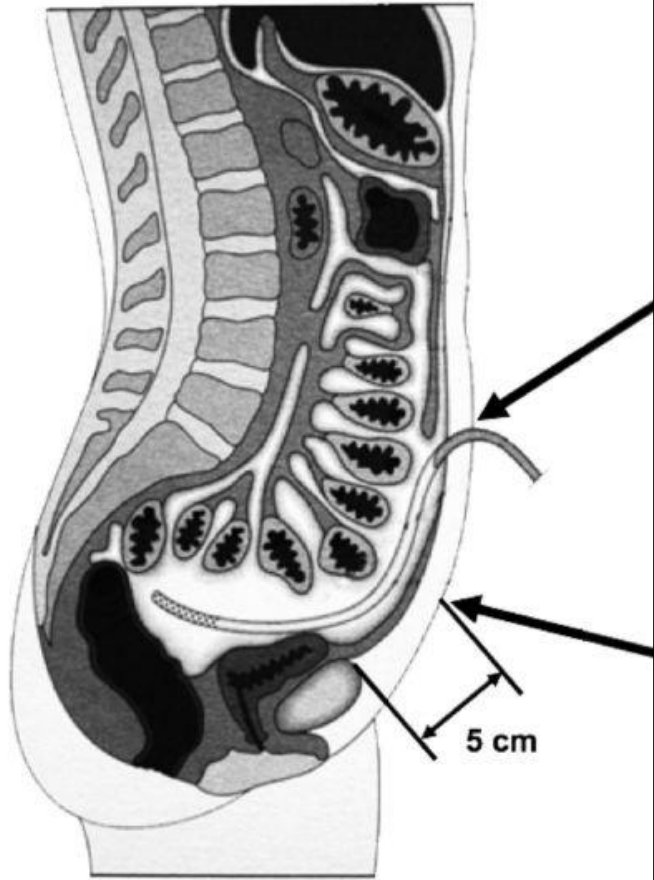
*Principali incisioni della parete addominale anteriore
utilizzate per accedere alla cavità peritoneale*



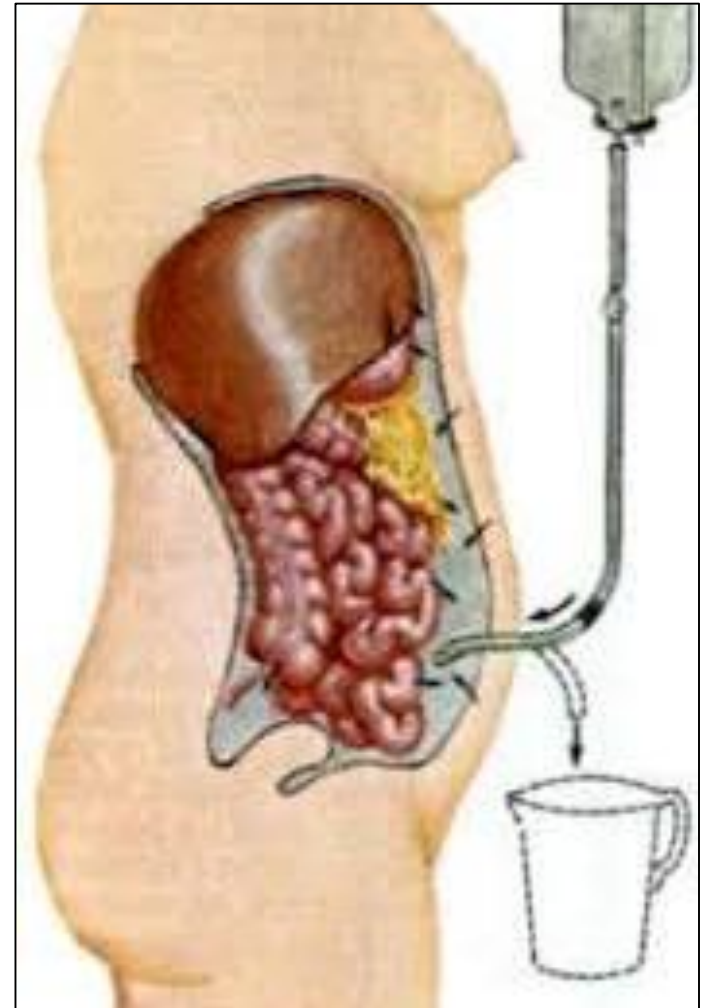
1 = incisione iliaca, detta di Roux, per gli ascessi appendicolari; 2 = incisione sul margine laterale del retto, o para-rettale, detta di Jalaguier; 3 = laparotomia mediale sopra- e sotto-ombelicale; 4 = laparotomia laterale; 5 = via trans-rettale, utilizzata per l'impianto stabile dei cateteri di Tenckhoff.

Principle of Peritoneal Dialysis

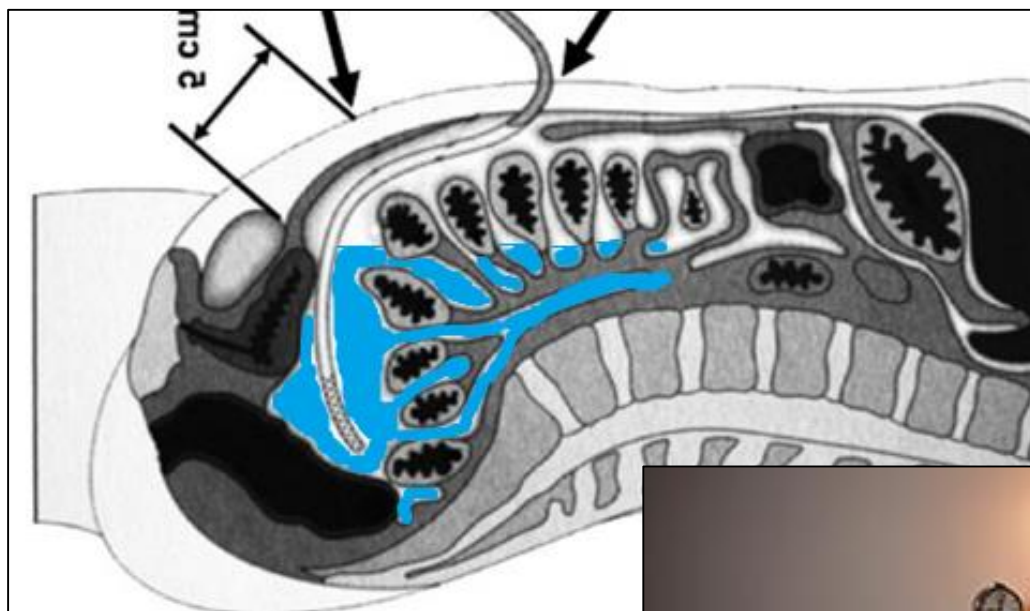


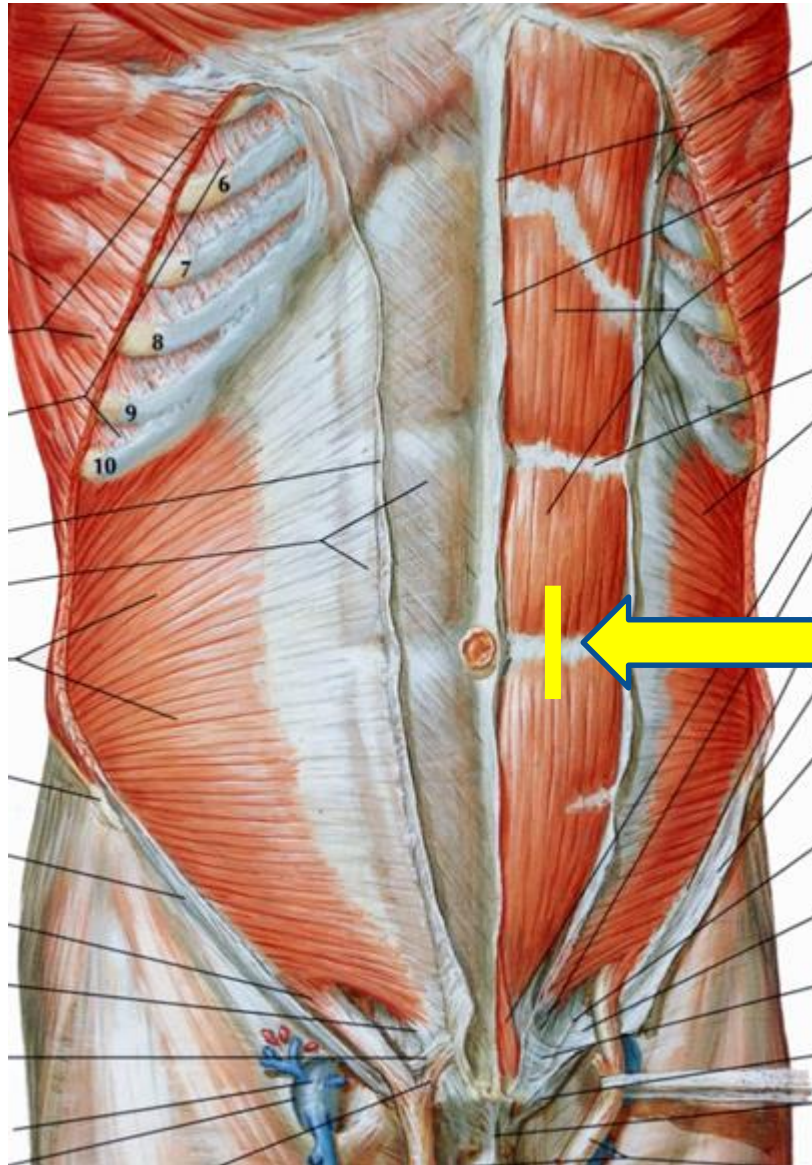


Dialisi peritoneale manuale



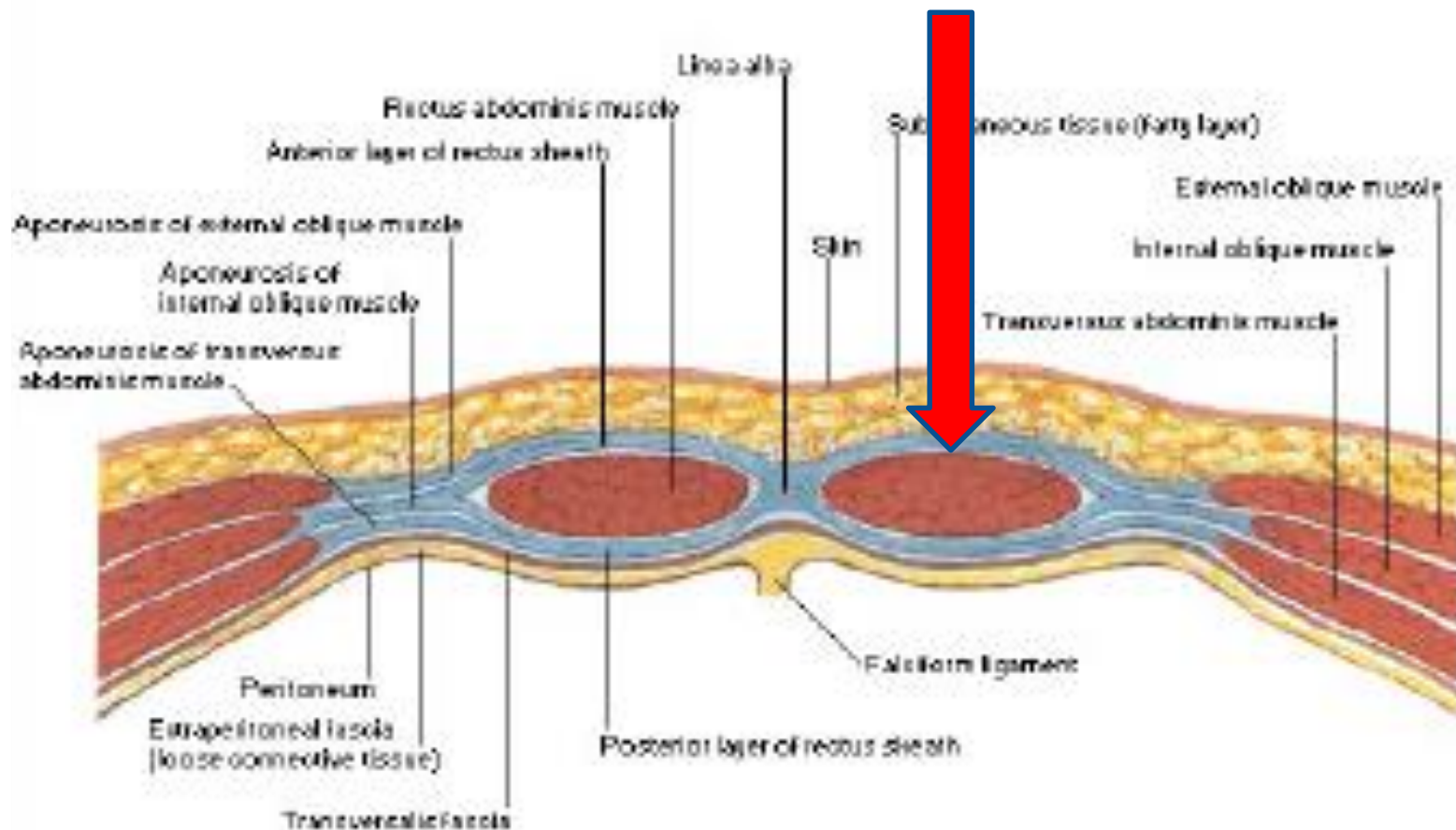
Dialisi peritoneale automatizzata



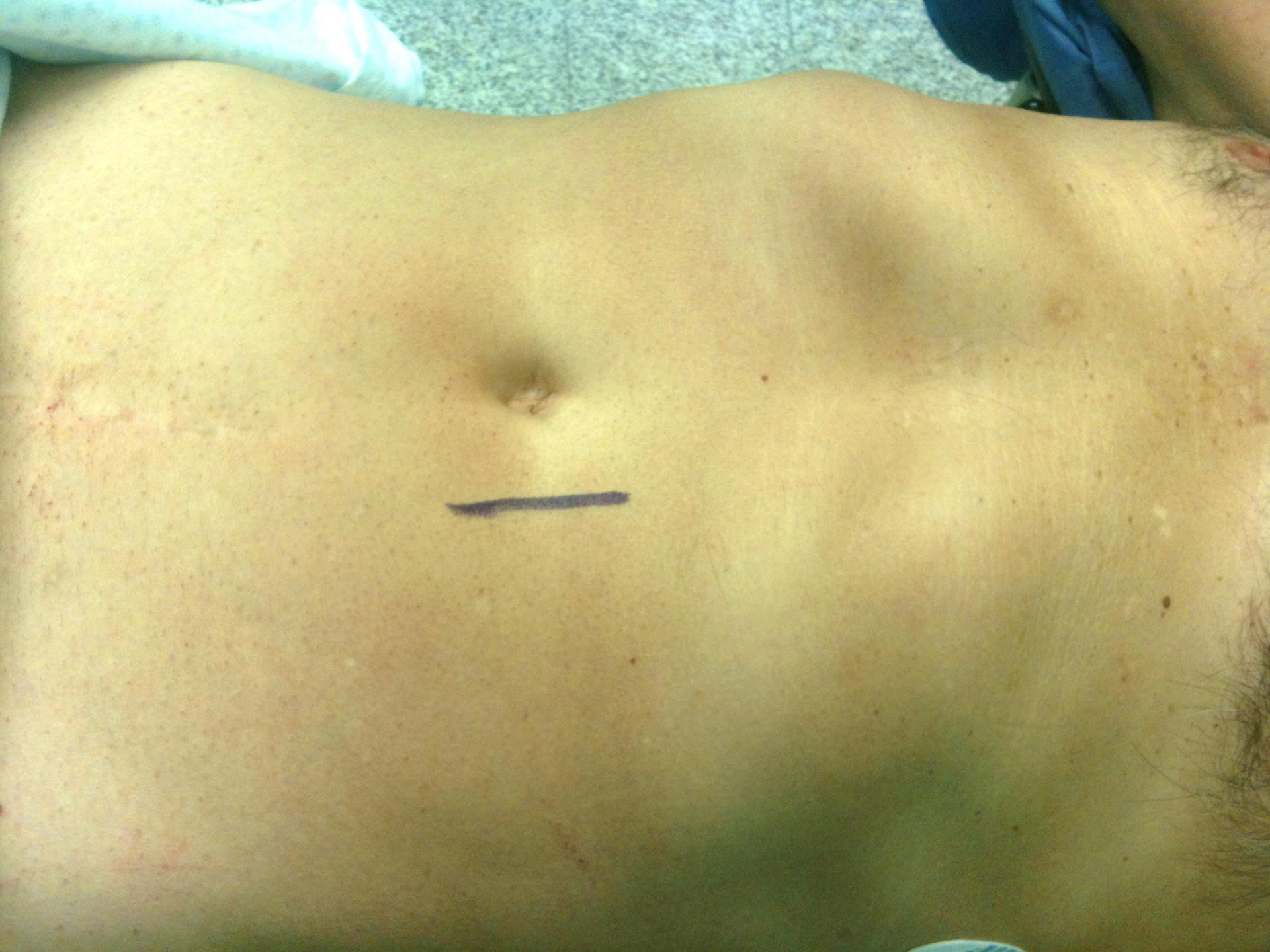


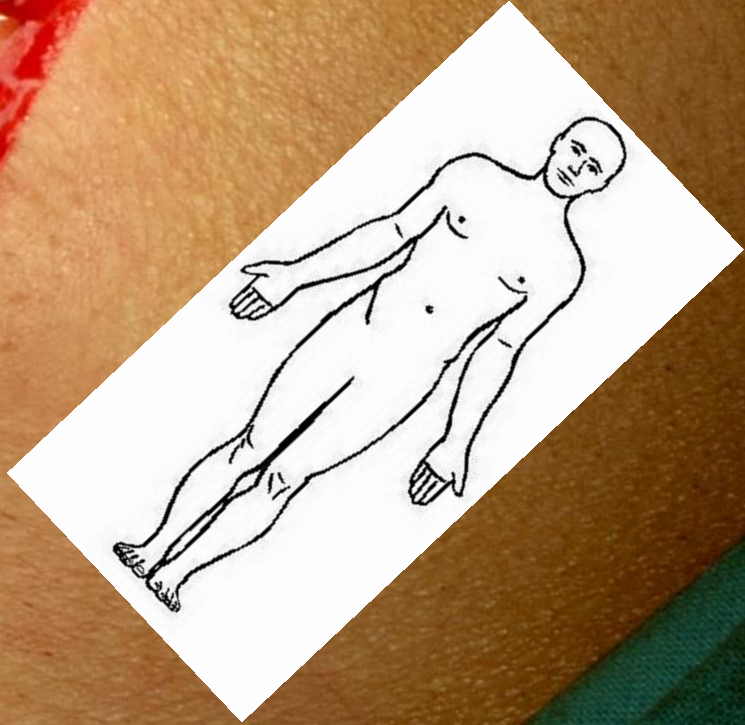
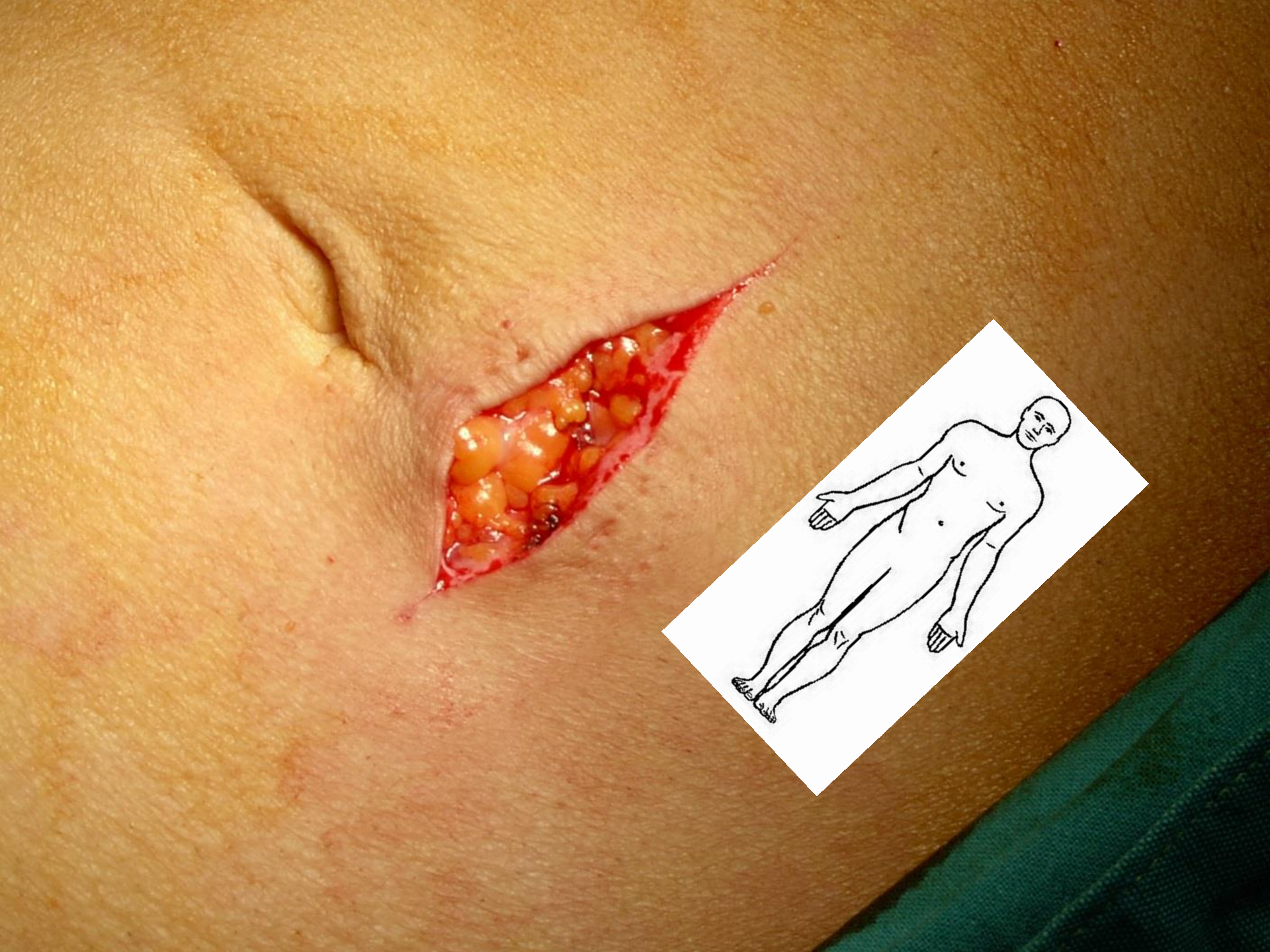
Rectus Sheath

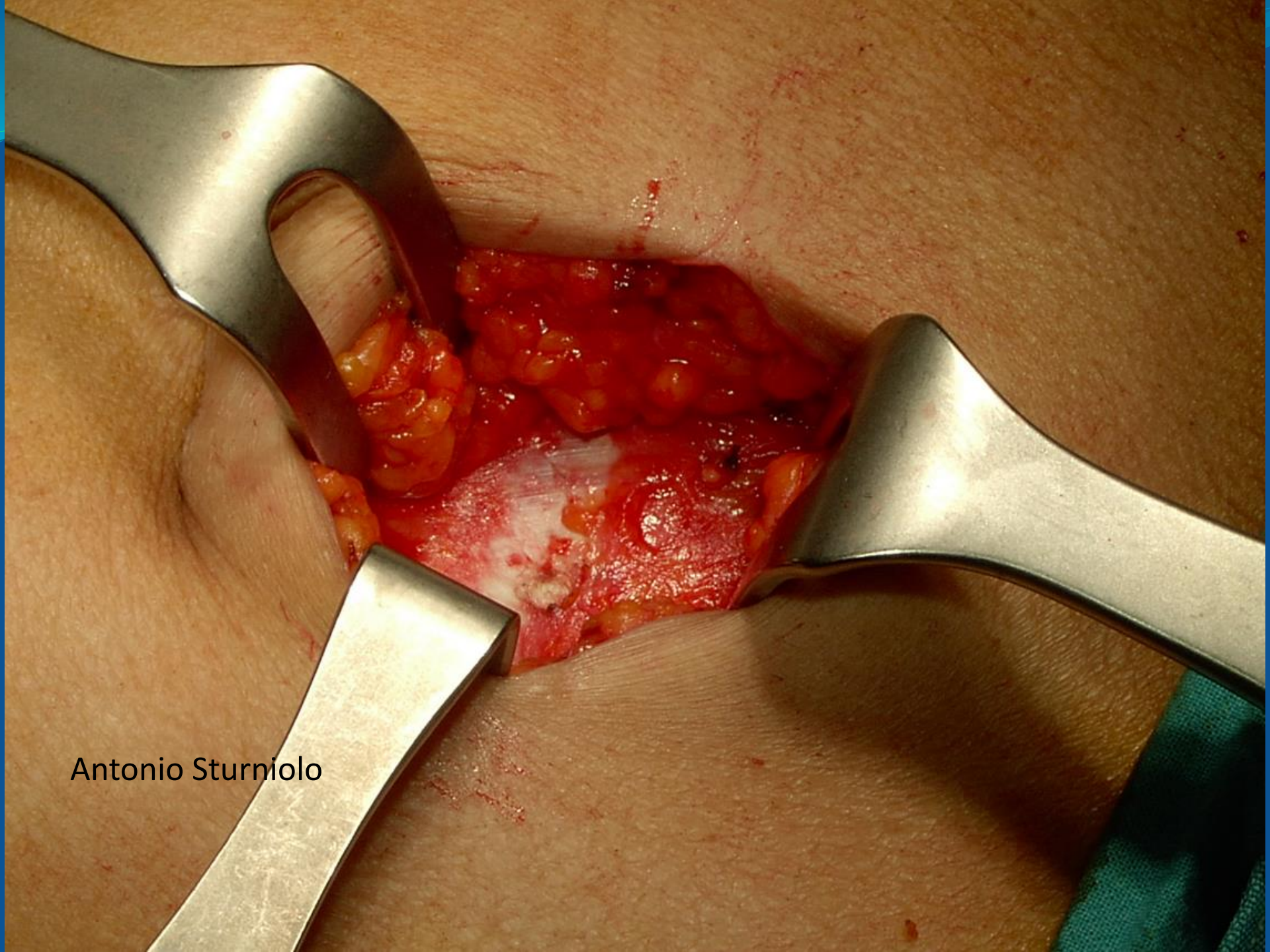
Cross Section Above Arcuate Line



Aponeurosis of internal oblique muscle splits to form anterior and posterior layers of rectus sheath. Aponeurosis of external oblique muscle joins anterior layer of sheath; aponeurosis of transverse abdominis muscle joins posterior layer. Anterior and posterior layers of rectus sheath unite medially to form linea alba.



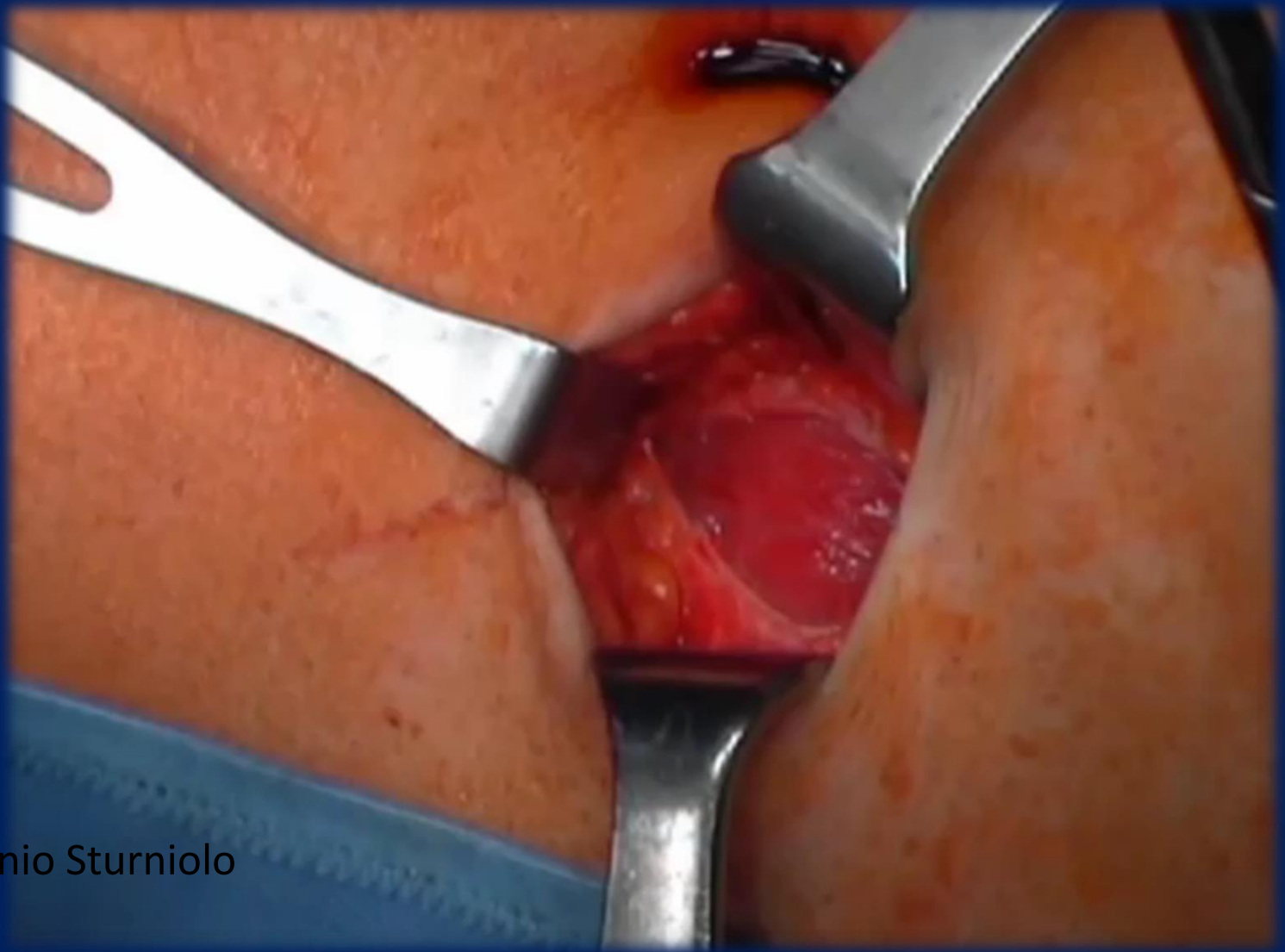




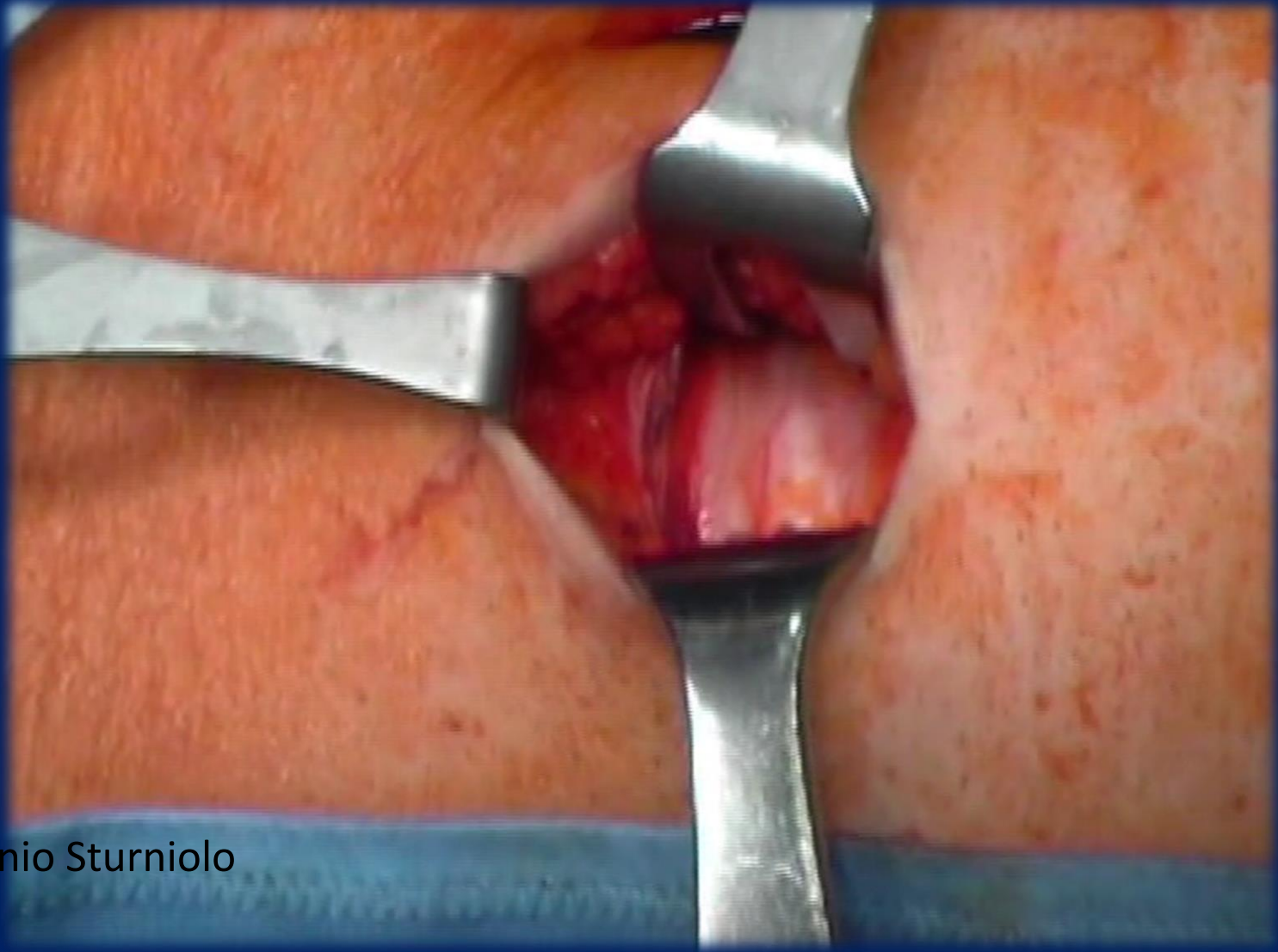
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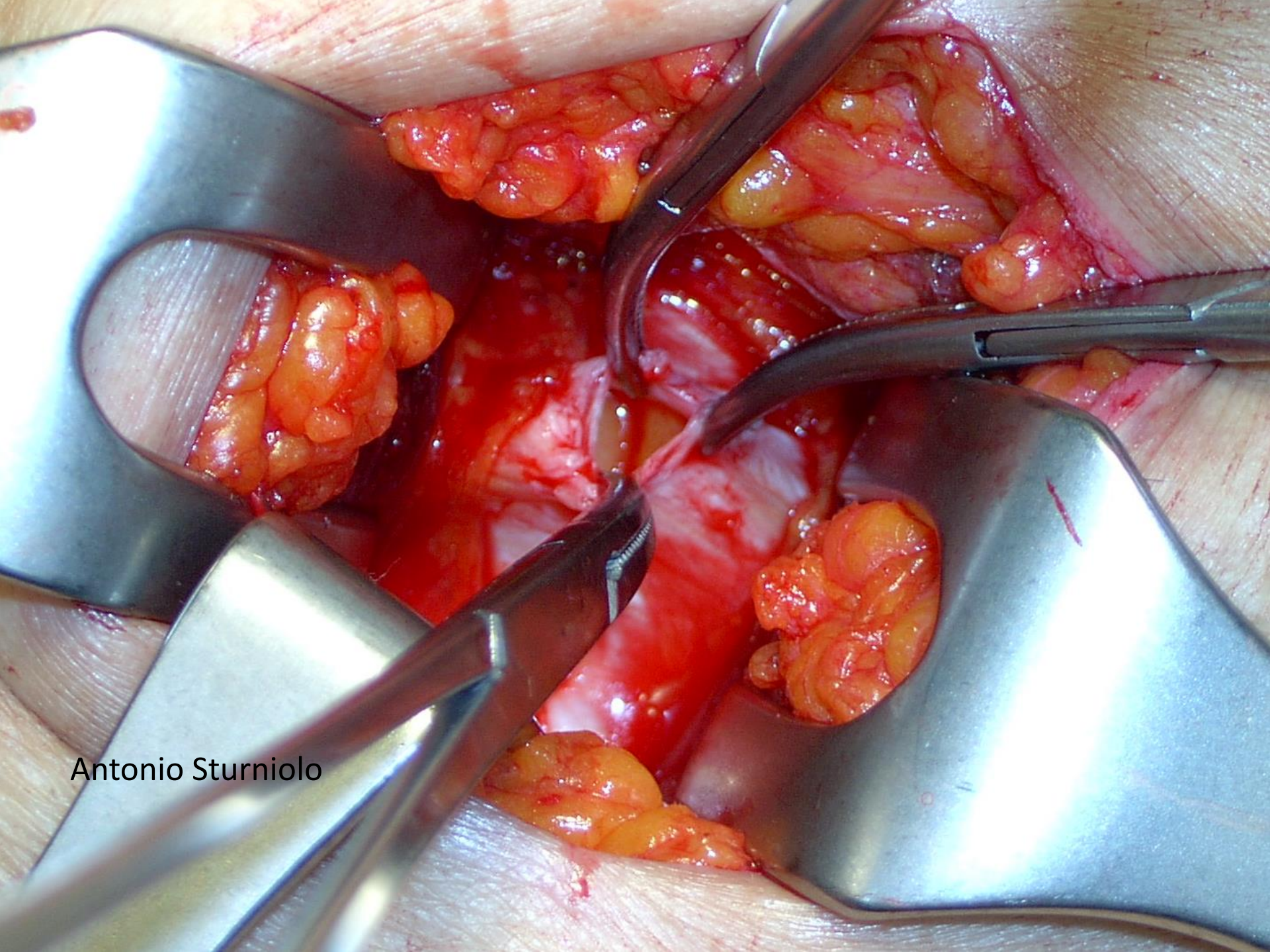
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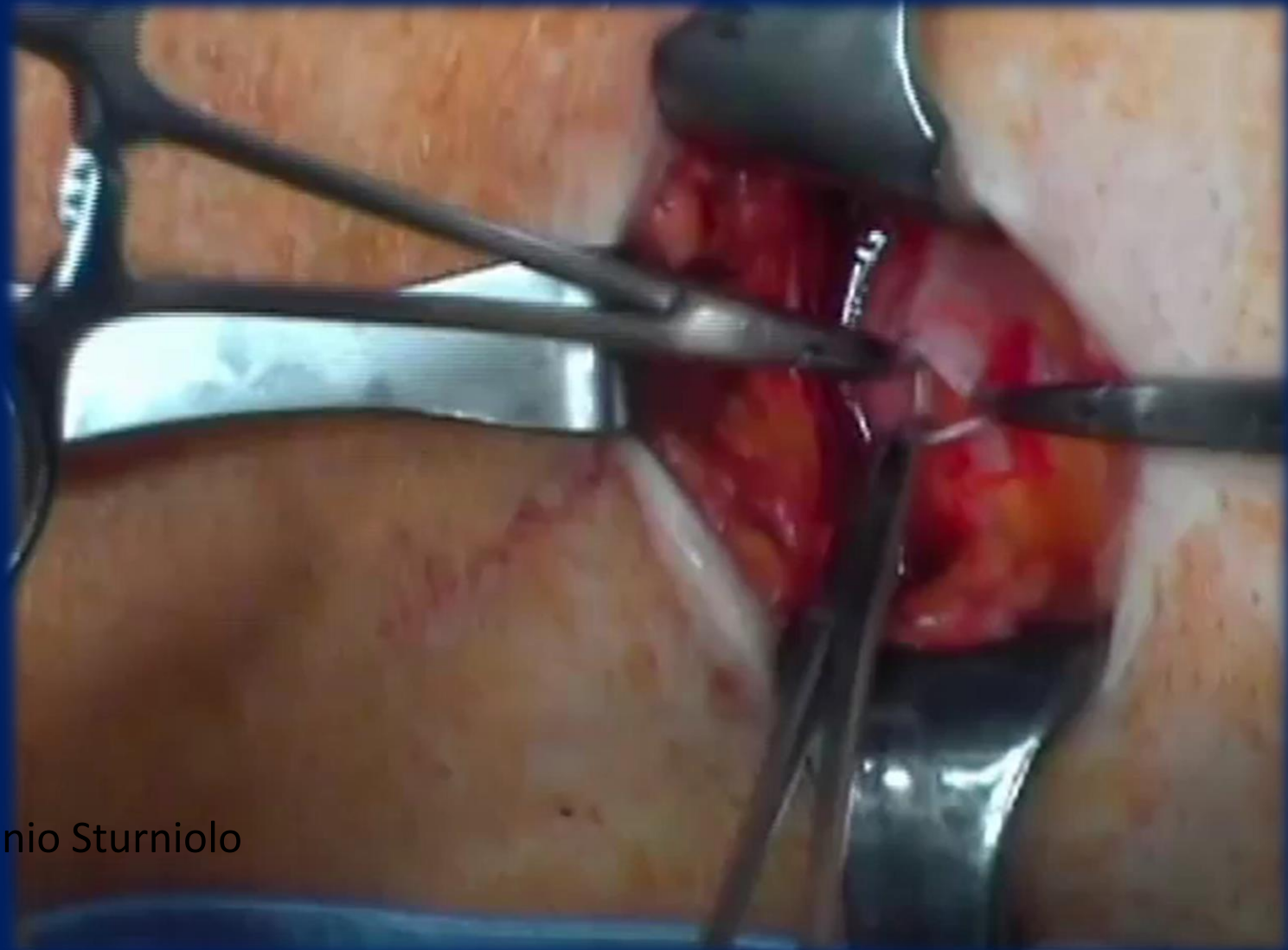
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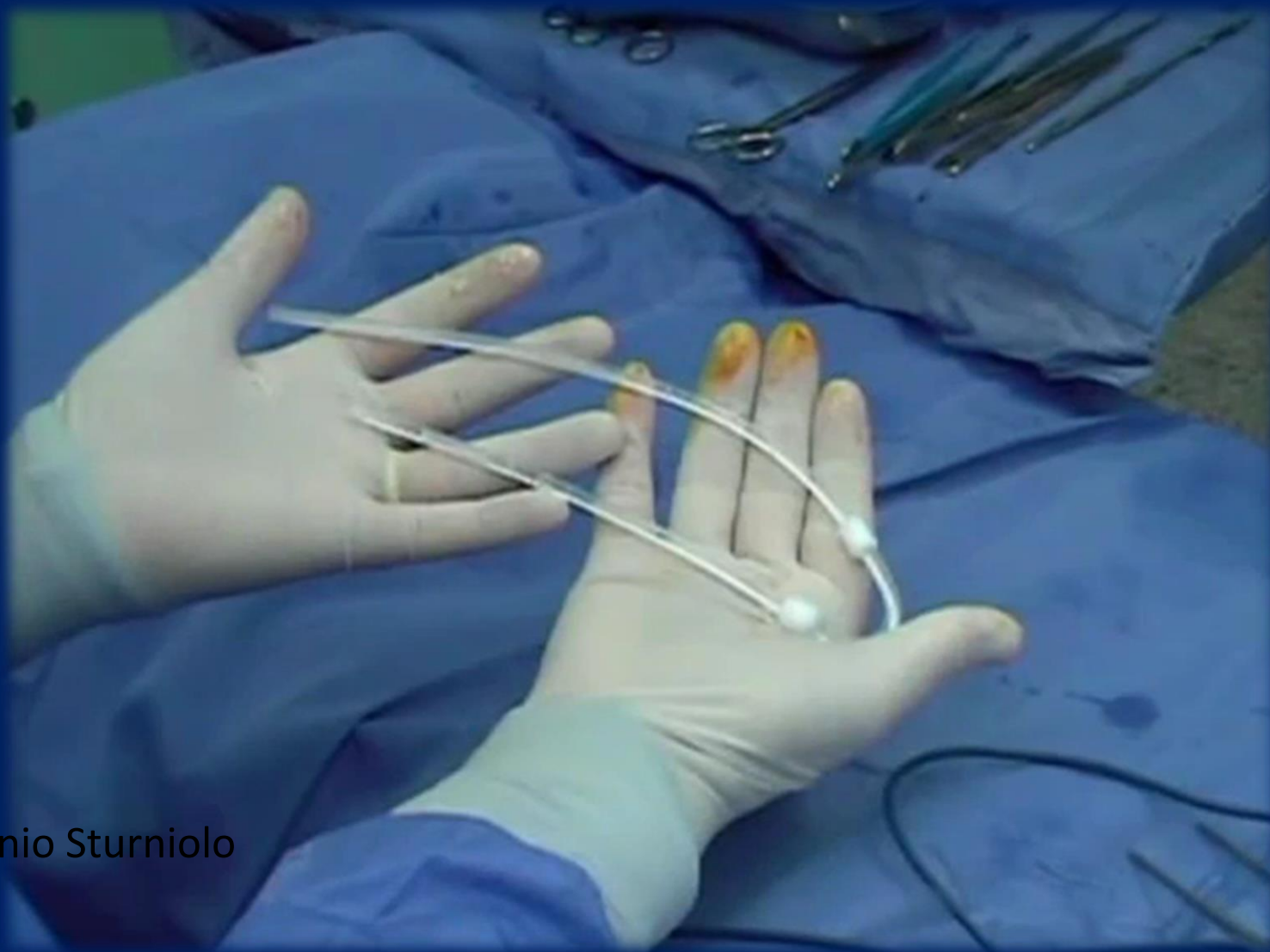
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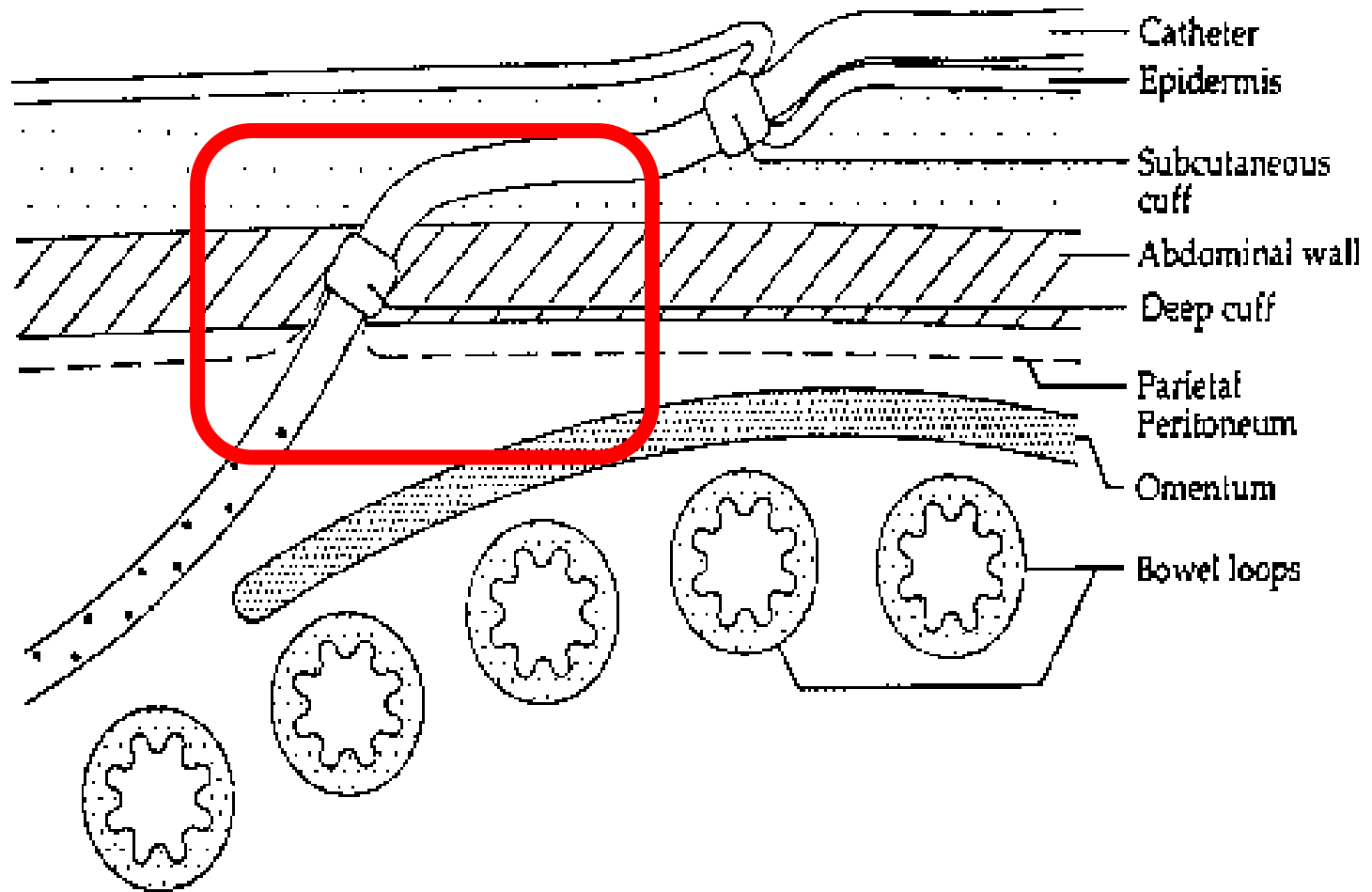


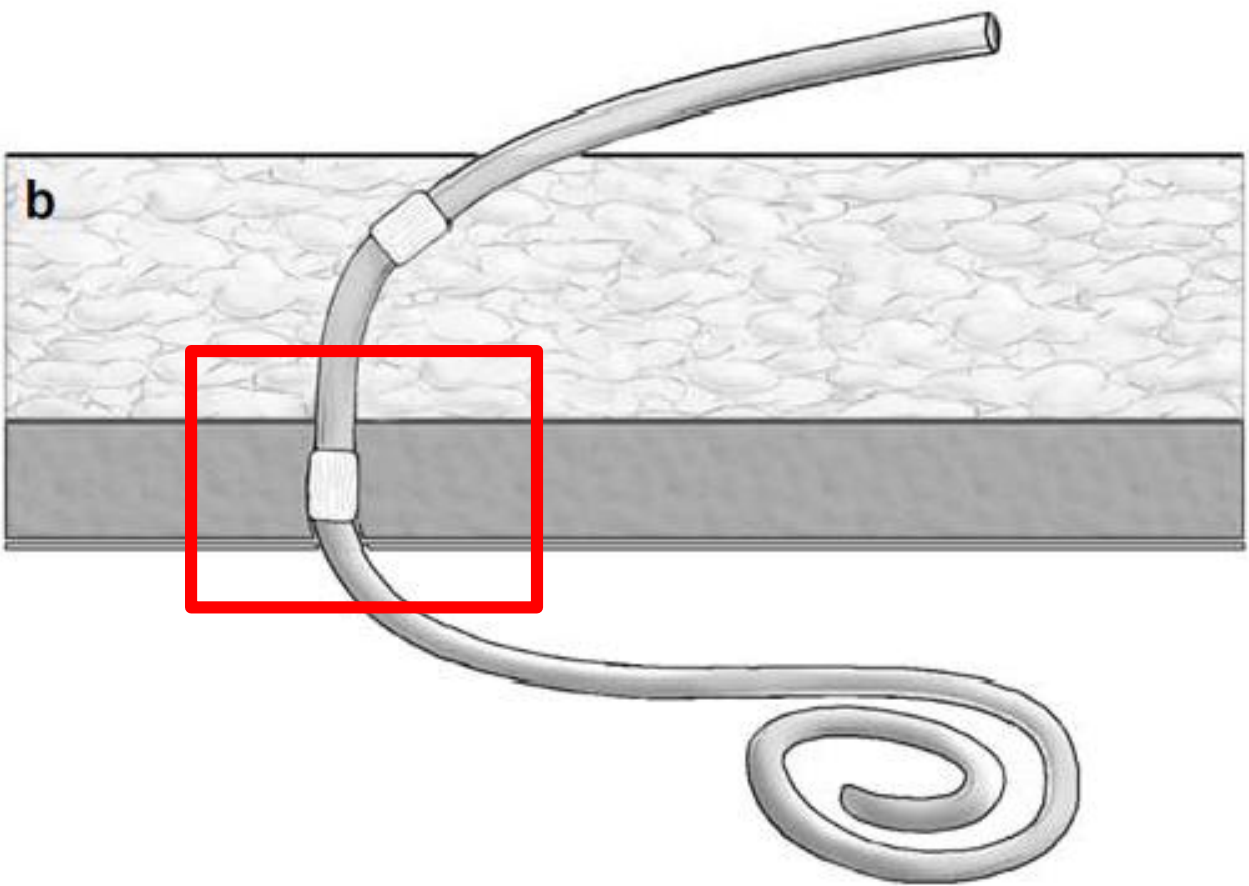
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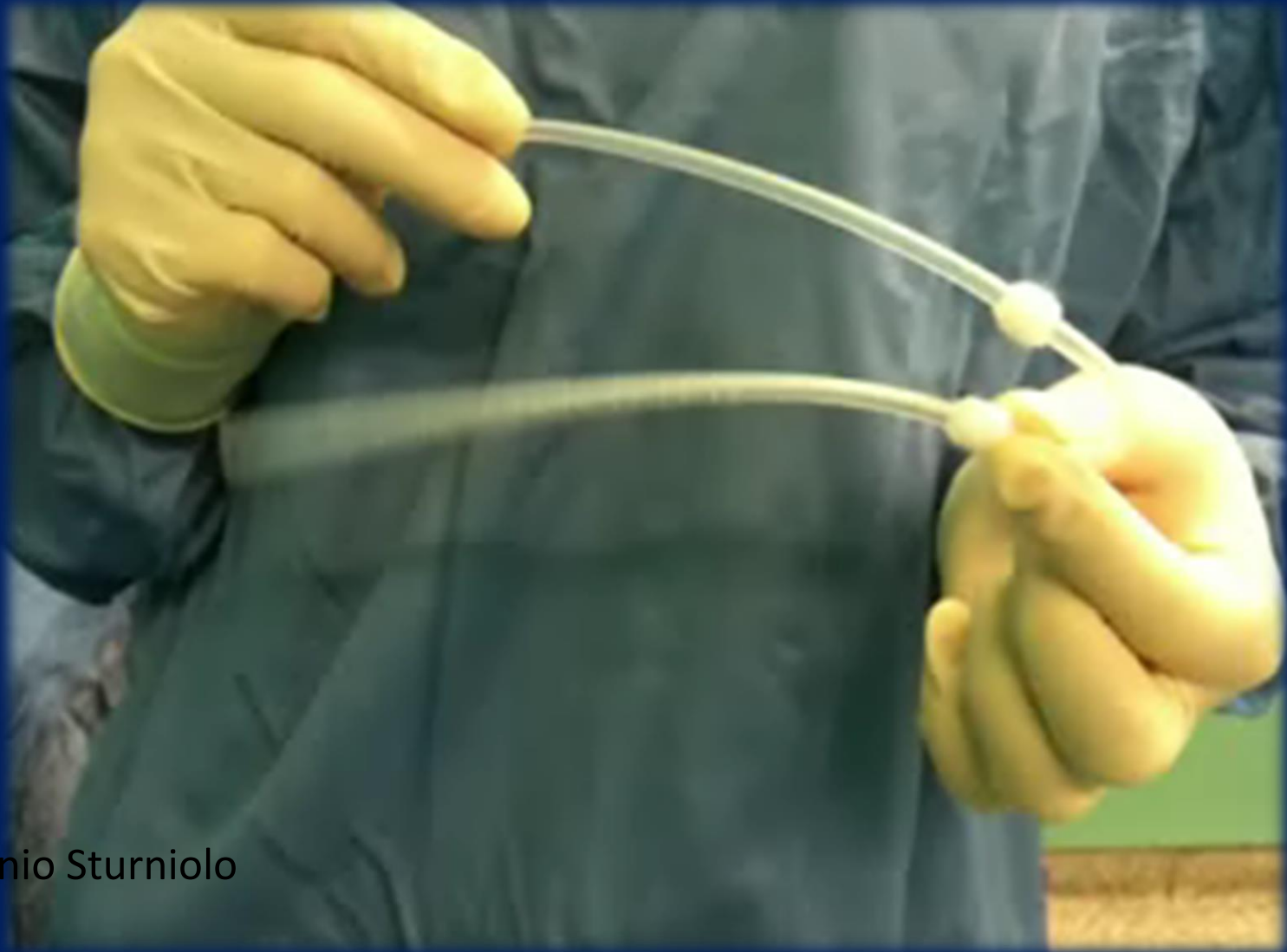


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Normal Catheter Anatomy

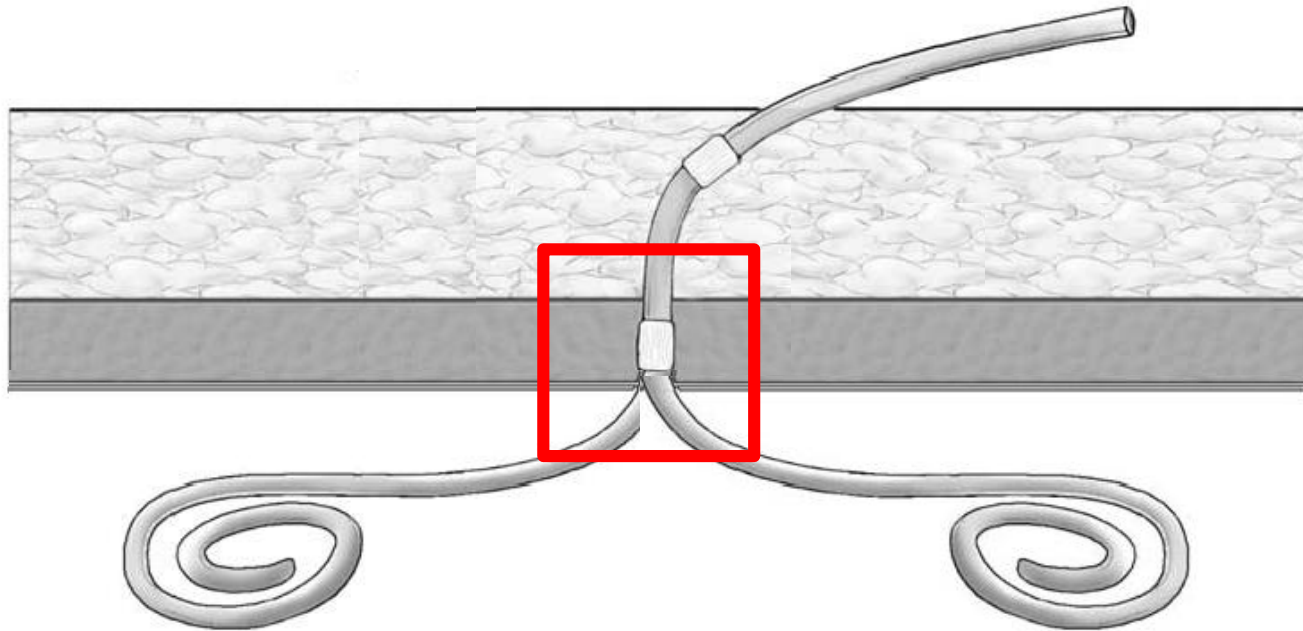




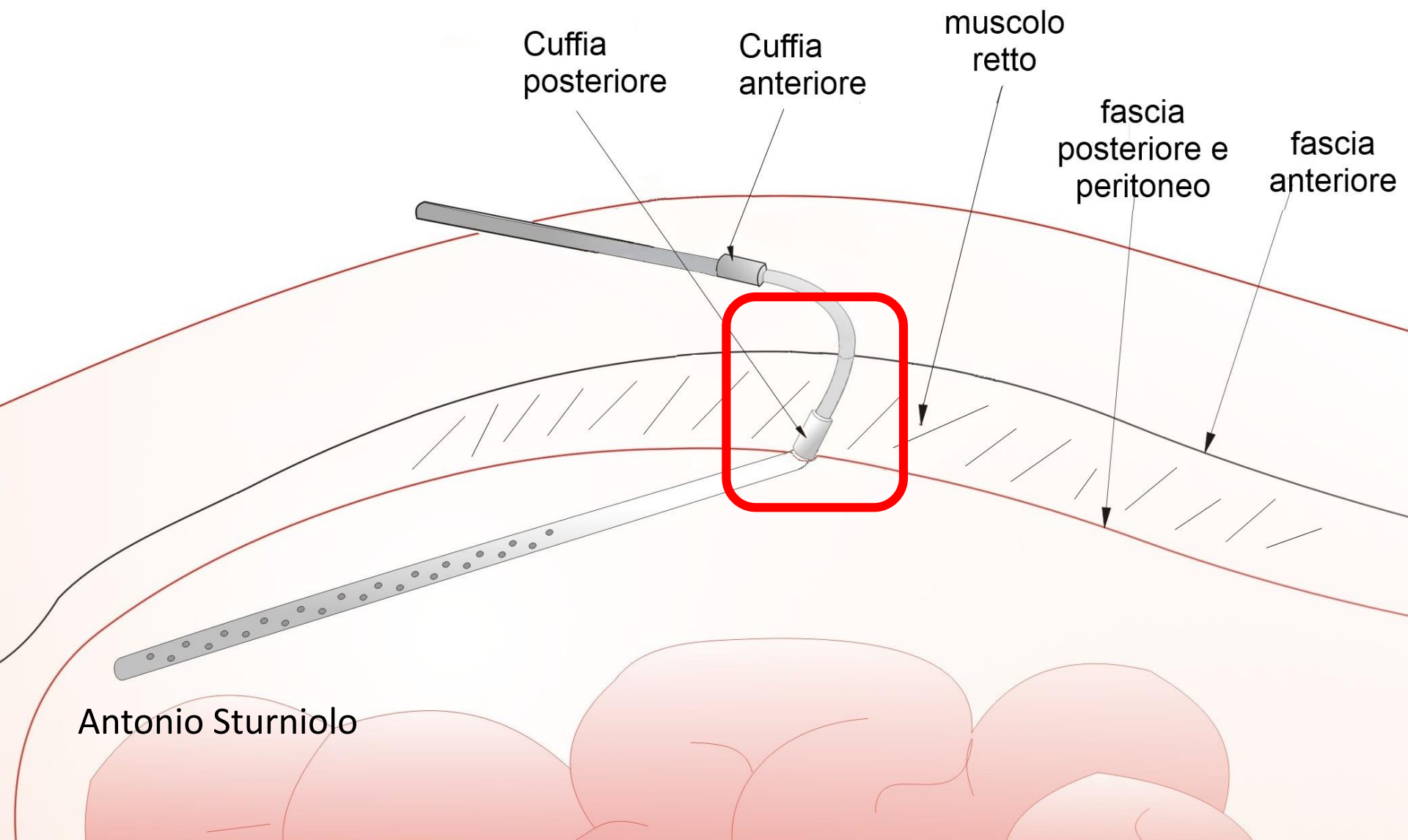


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Dislocazione



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Cuffia
posteriore

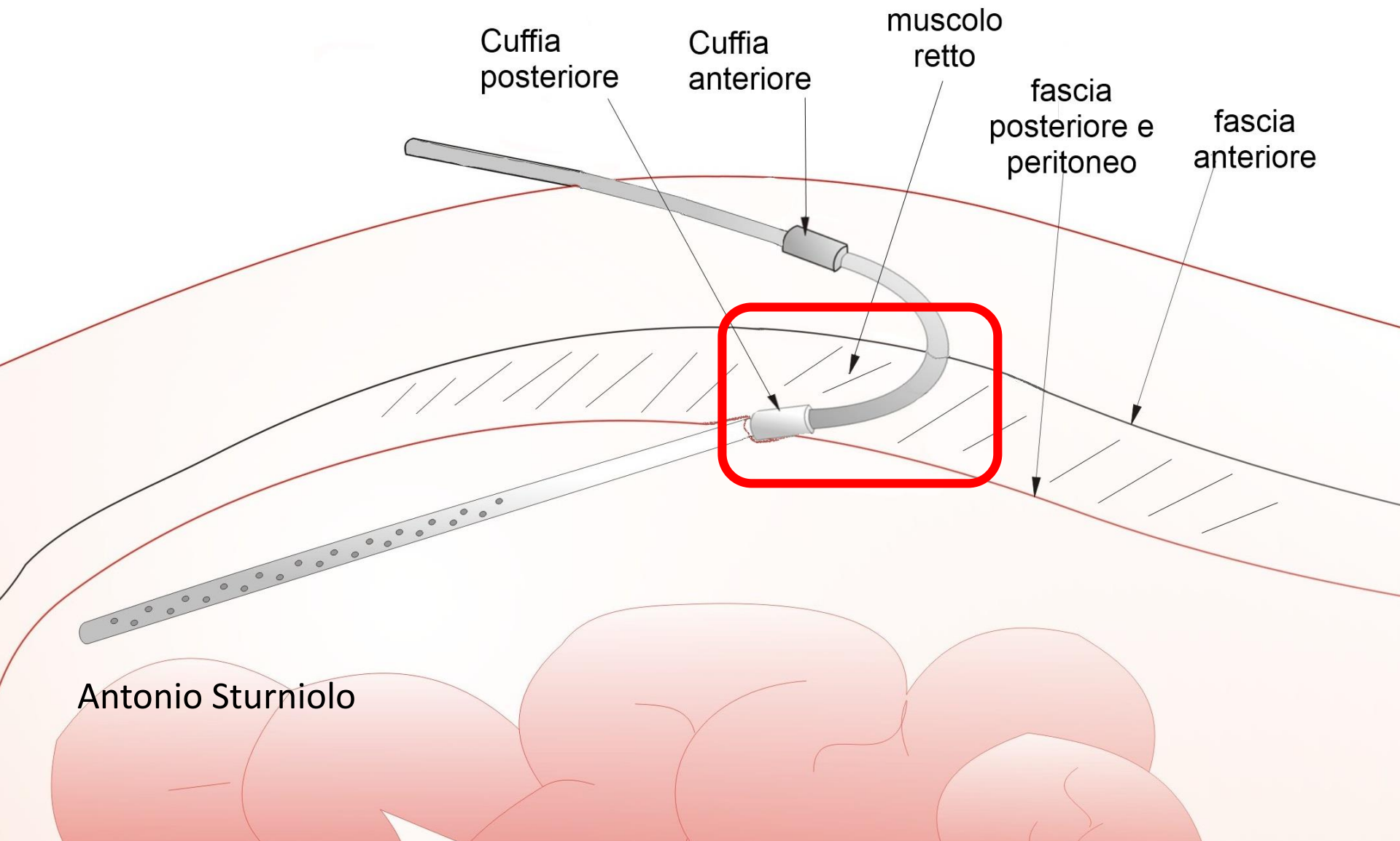
Cuffia
anteriore

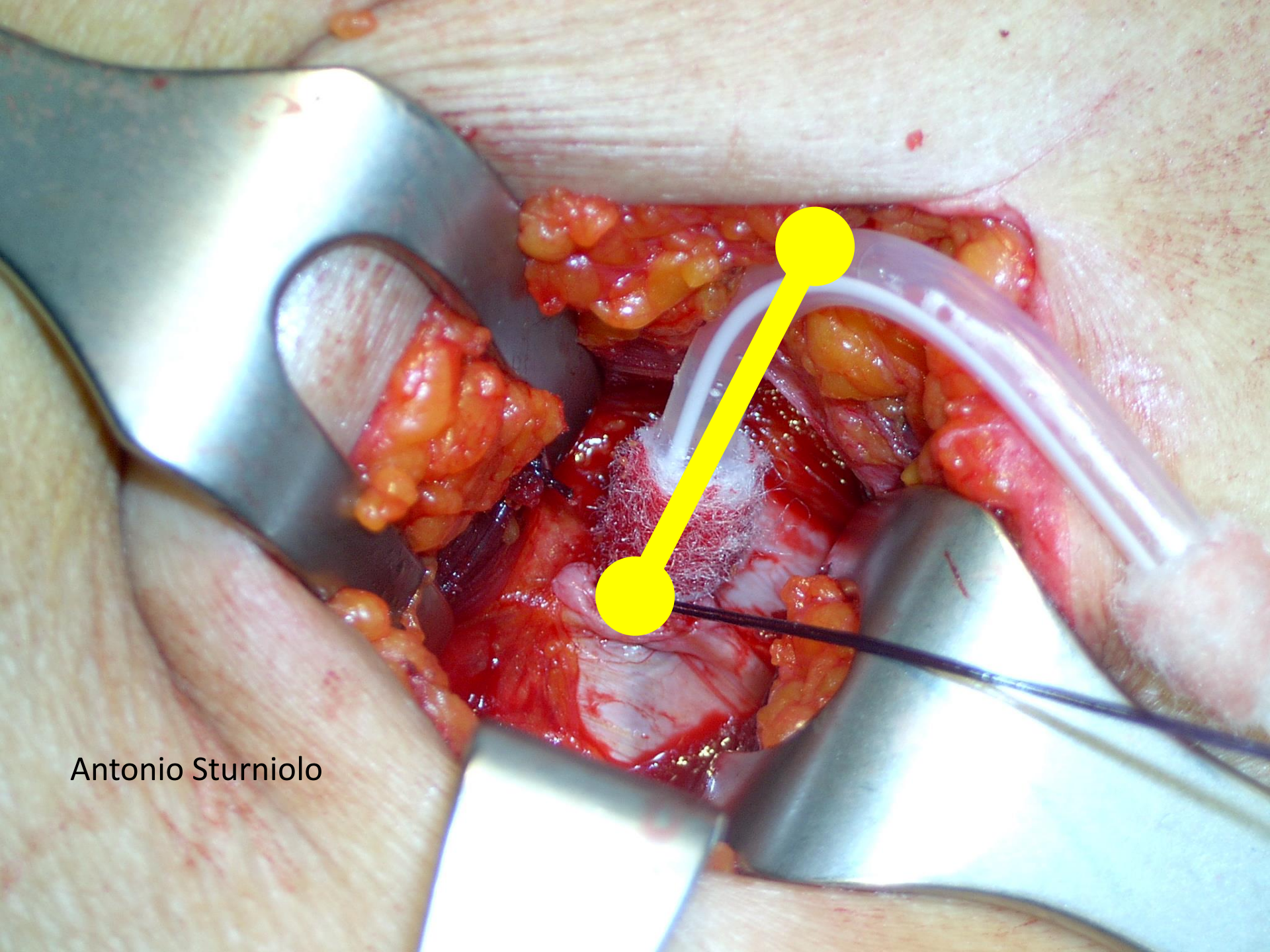
muscolo
retto

fascia
posteriore e
peritoneo

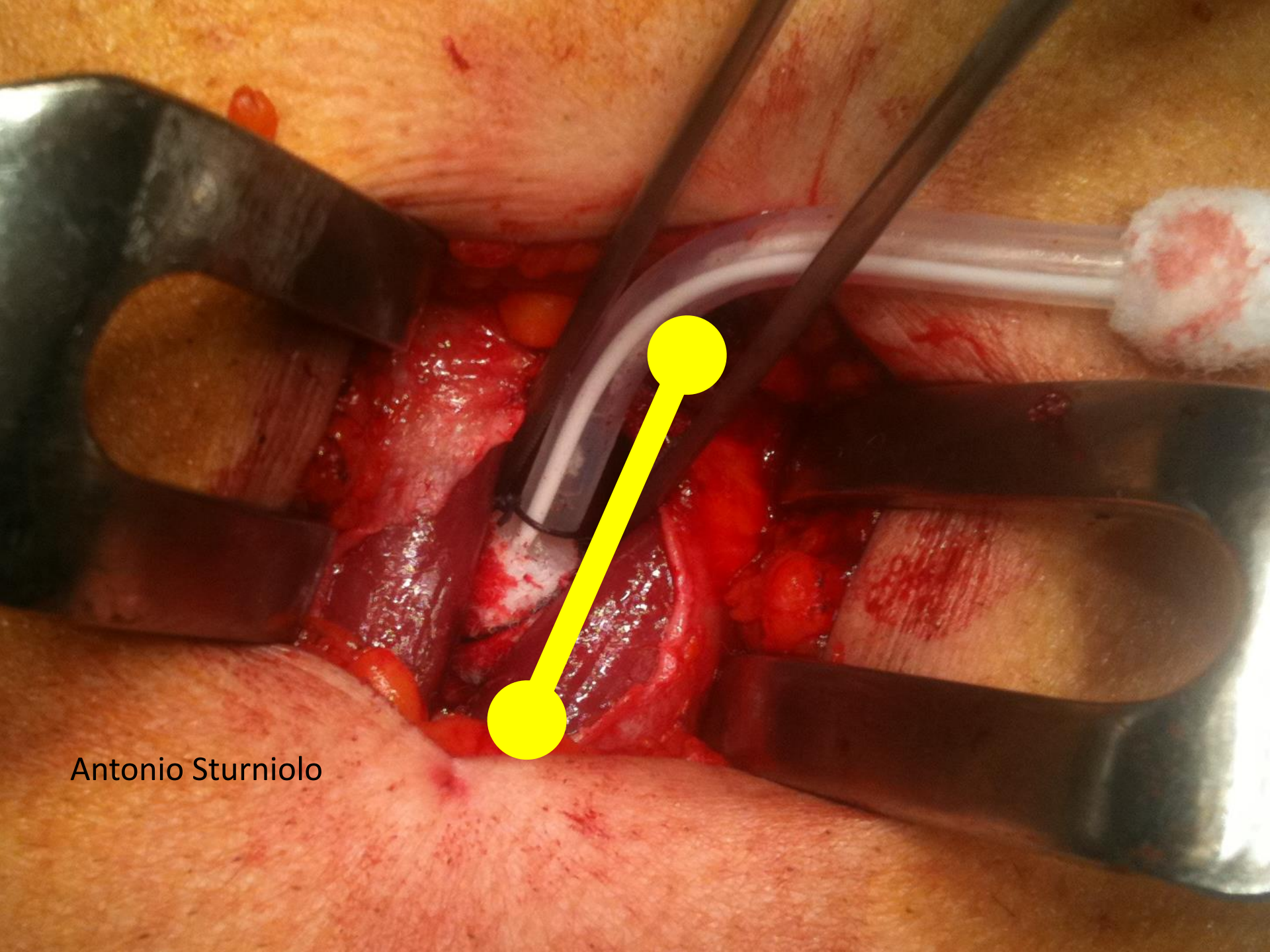
fascia
anteriore

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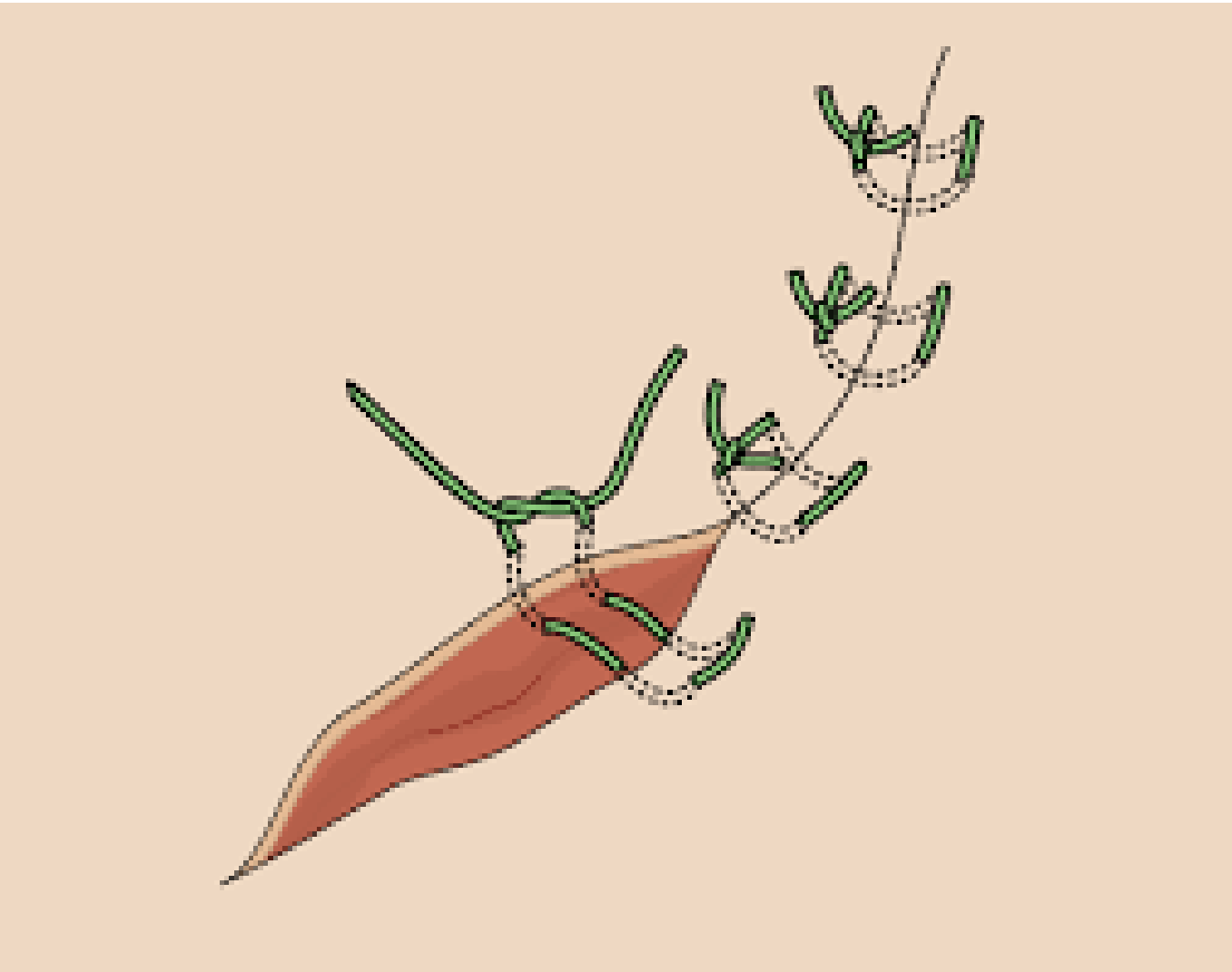




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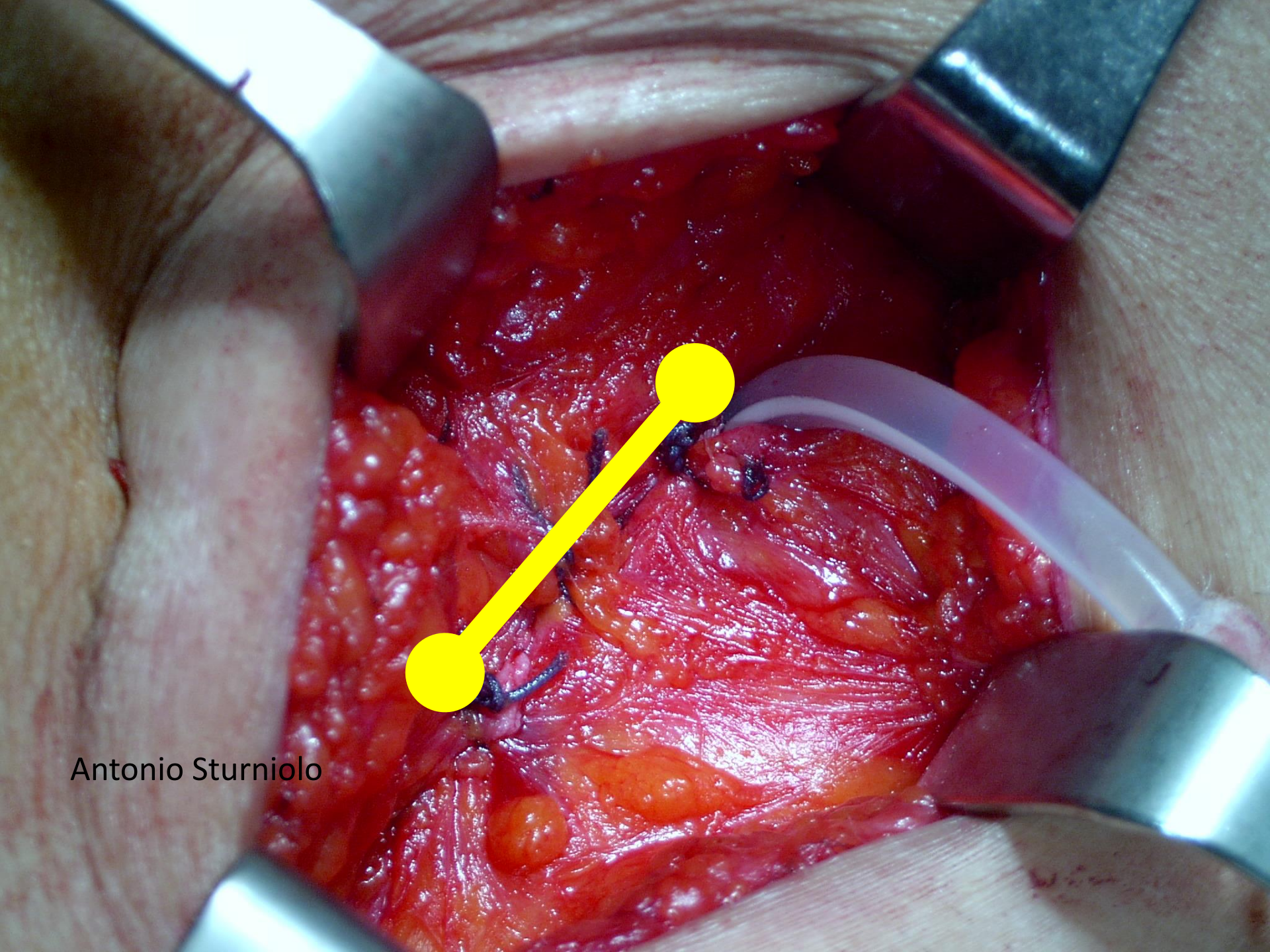


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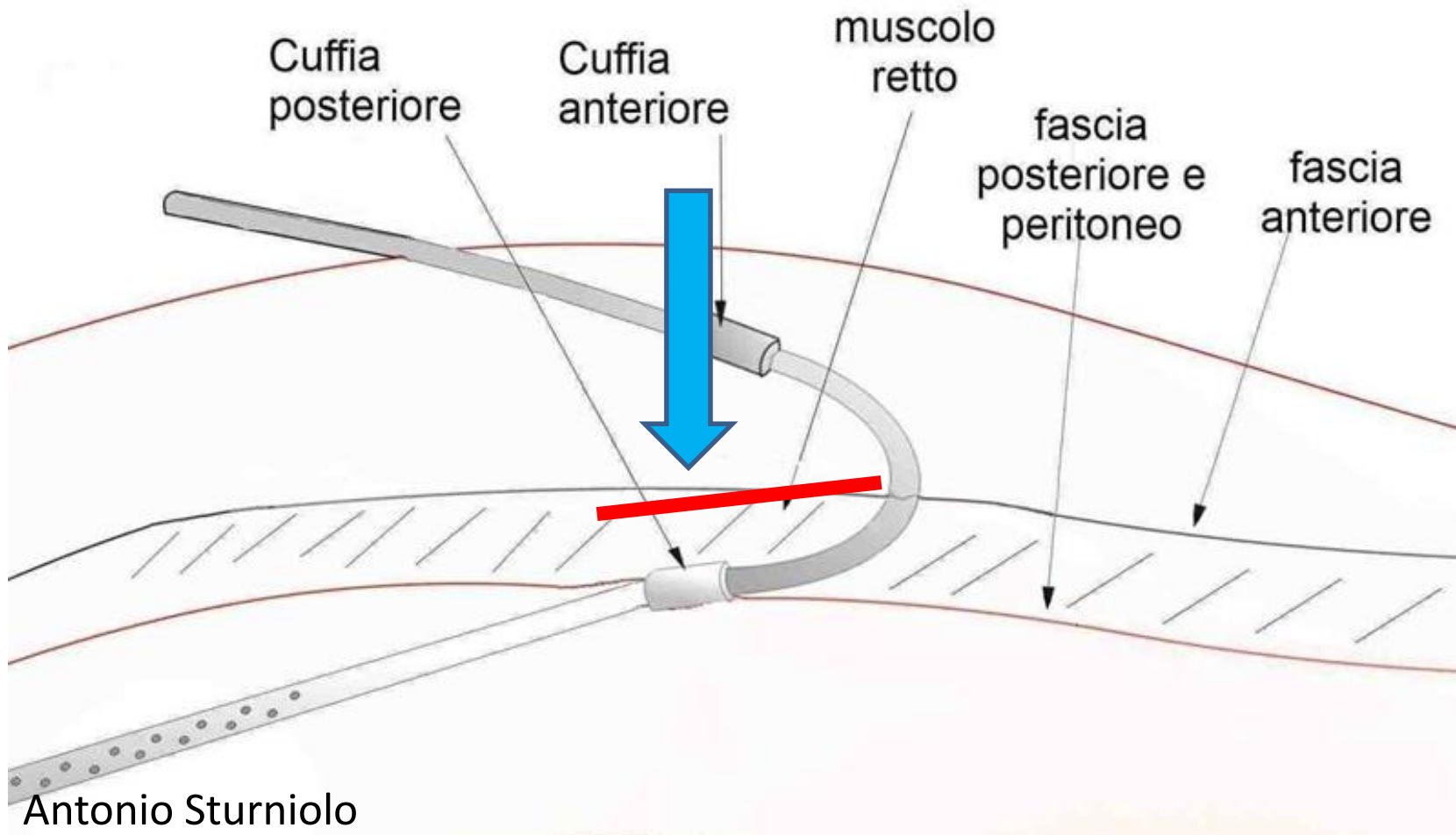


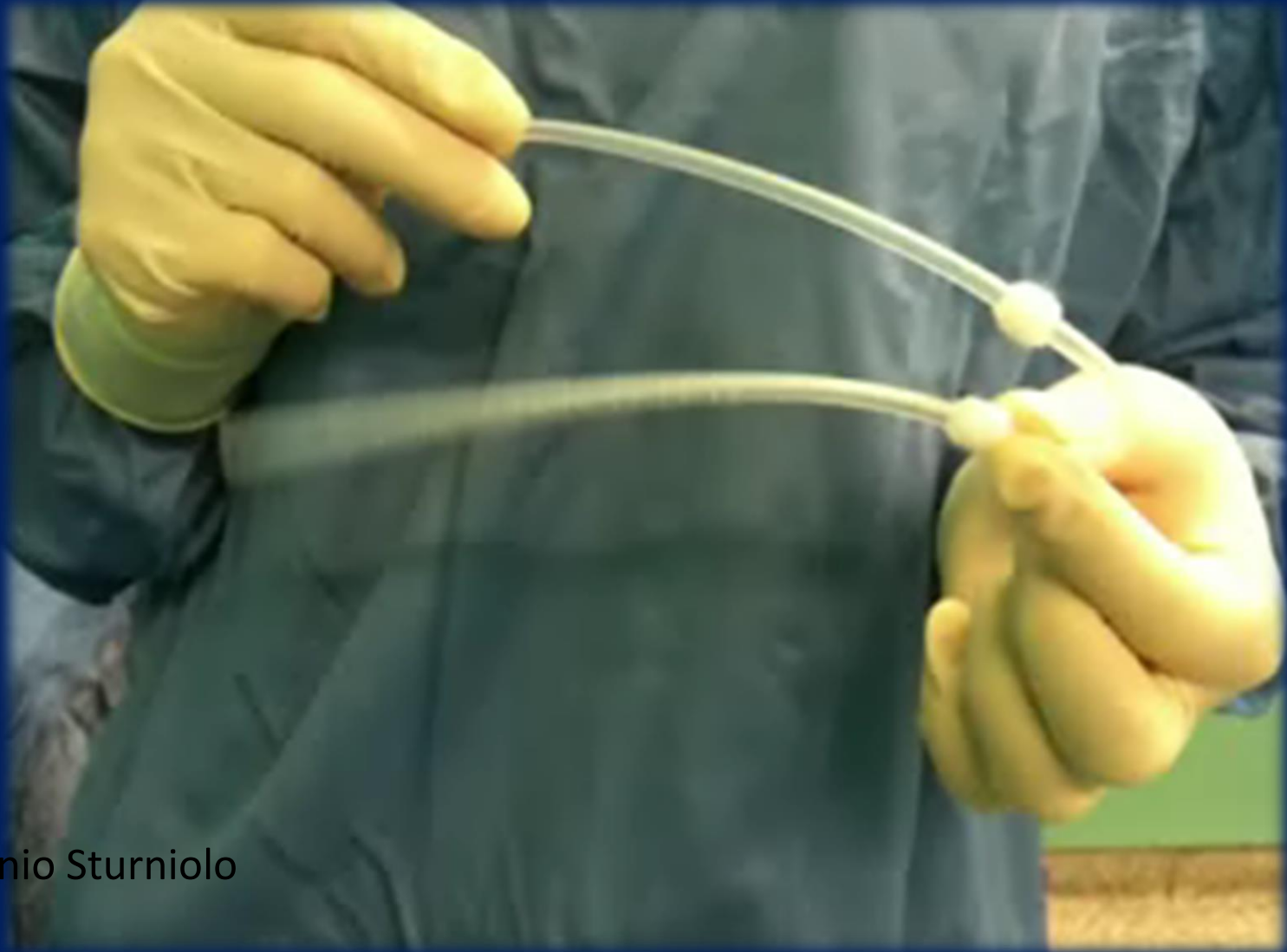


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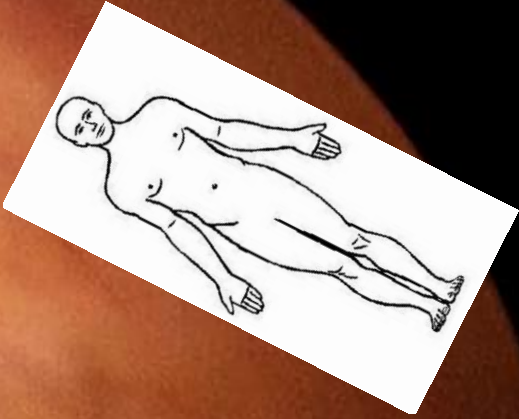


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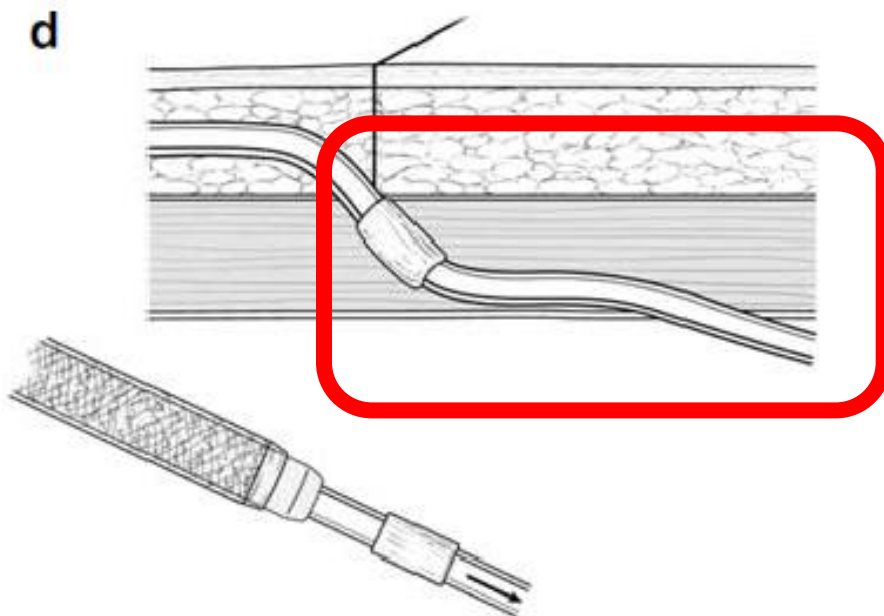
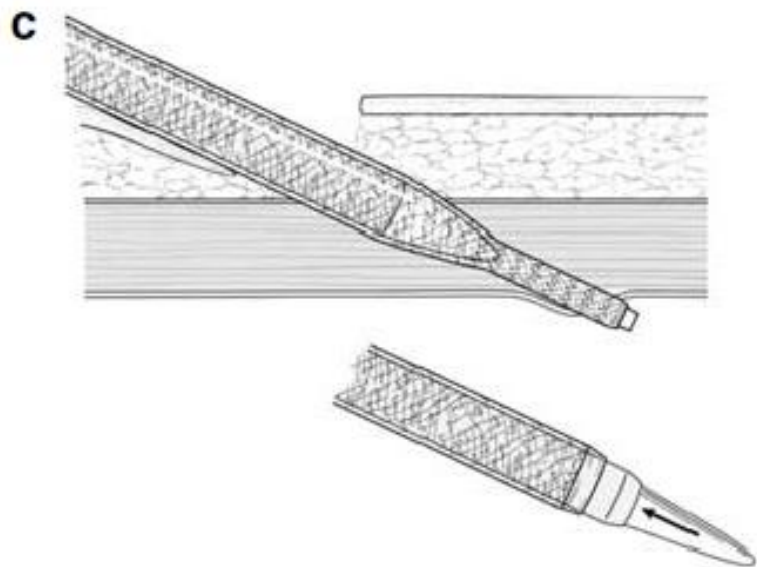
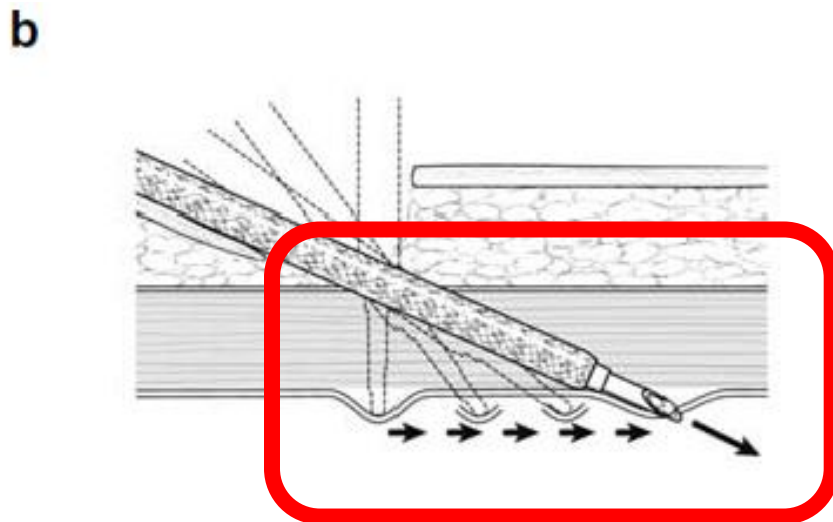
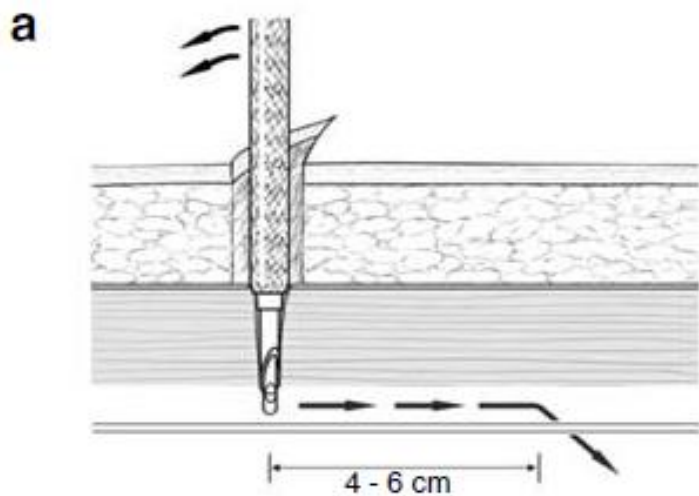


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John H. Crabtree



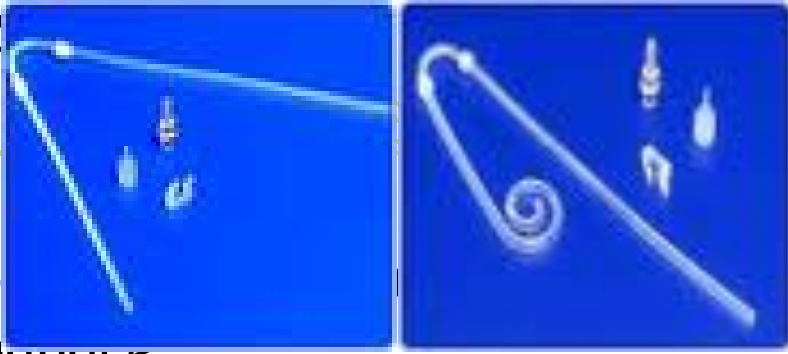


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Perit Dial Int. 1996;16 Suppl 1:S333-5.

A prospective randomized comparison of the Swan neck, coiled, and straight Tenckhoff catheters in patients on C

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Lee EJ.



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Department o
 Hospital, Singapore. ty

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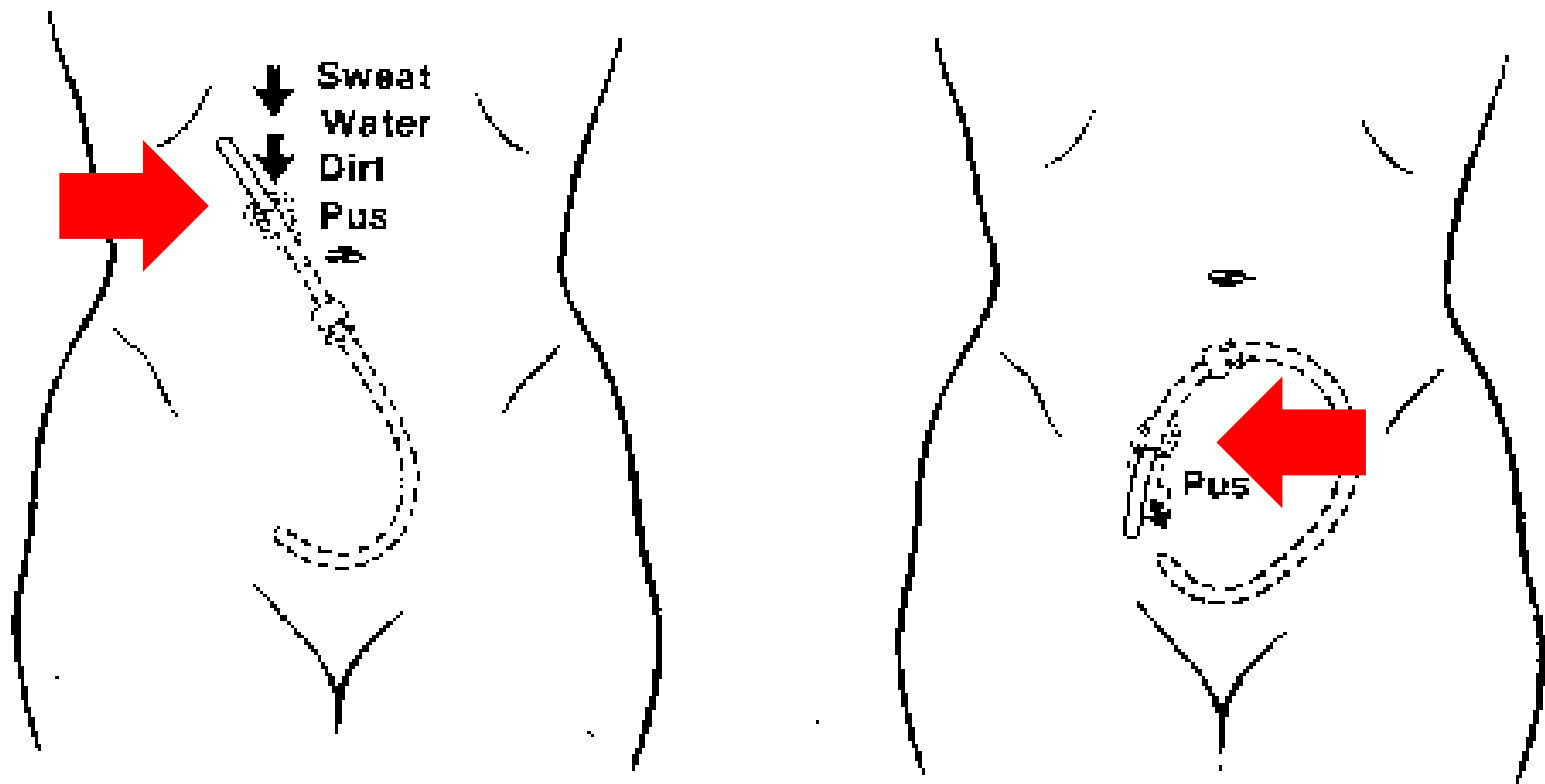
The Swan neck configuration resulted in a significant reduction in the rate of exit-site infections.

Ng
 al, The

University of Hong Kong, Hong Kong SAR, China.

Exit Site Placement

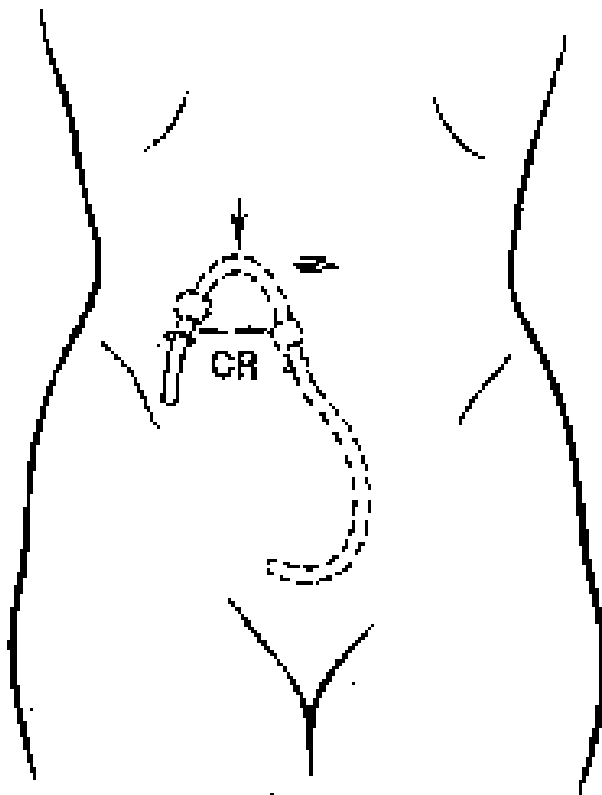
UPWARD AND DOWNWARD TUNNEL DIRECTION—
EXIT SITE INFECTION



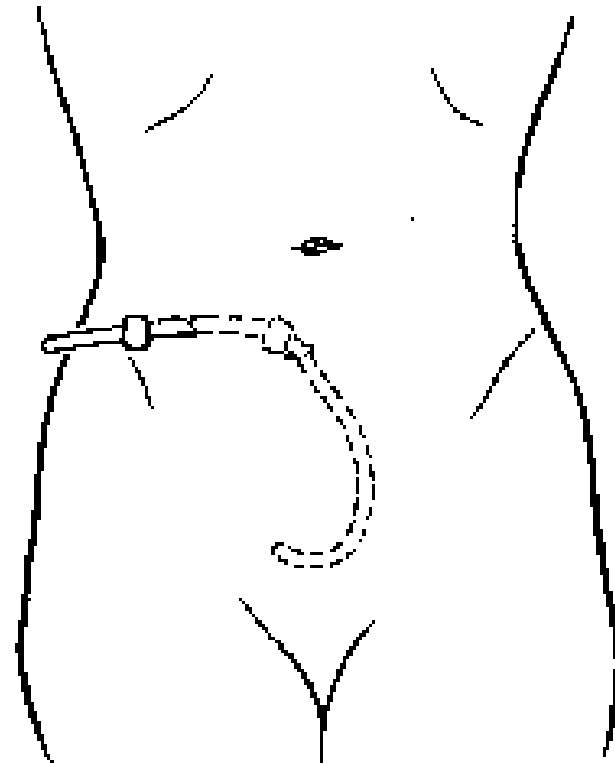
Double Cuff - Straight Catheter

DOUBLE CUFF TENCKHOFF CATHETER

Placement



External Cuff Extrusion



CR = Catheter Resilience

- Il catetere peritoneale più usato al mondo è il Tenkhoff (65 % di tutti i cateteri impiantati al mondo) seguito dallo Swan-neck che è il più utilizzato in Europa.
- Studi degli ultimi dieci anni mostrerebbero che lo Swan-neck con doppia cuffia sia gravato da una minor incidenza di migrazione rispetto al catetere retto



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Casistica personale

- 752 Cateteri impiantati (2000/2022)
- Al follow up incidenza di dislocazione del catetere dello 0%.
- Wrapping omentale 59 casi (risolto con tecnica laparoscopica)

Conclusioni

- Esiste la possibilità di ottenere ottimi risultati utilizzando un normale catetere di Tenckhoff Swan-neck con una tecnica chirurgica semplice, senza metodiche e/o cateteri complessi e costi aggiuntivi.
- Oltre alla riduzione delle complicanze collegate all'impianto, con un catetere peritoneale ben posizionato nel punto ideale, si riesce ad ottenere una massimizzazione delle performances di carico e scarico rendendo più efficienti gli scambi.

Grazie per l'attenzione