

**La Chirurgia della scoliosi:  
nell'Infanzia e nell'Adolescenza**

# Chirurgia Posteriore

- **Entro i 10 anni:** tempi chirurgici successivi sino alla correzione definitiva (artrodesi strumentata)
- **Adolescenza:** Correzione definitiva in un tempo unico (artrodesi strumentata)
- **Adolescenza, scoliosi severa.**  
Correzione in due tempi chirurgici

# INFANZIA

## 1. Artrodesi strumentata subito: non più raccomandata

(Johnston et al. 2008, Vitale et al. 2008)

Early spinal fusion can control scoliosis progression, but would result in a short trunk and stunted growth of the thorax and lungs, with sometimes unsatisfactory results for the onset of crankshaft phenomenon, and negative effects on respiratory function.

## 2. Correzione strumentata senza fusione sino all'Artrodesi Definitiva



### “Growth Sparing” Sistemi allungabili

- Rib based (VEPTR) (Campbell et al)
- Spine based (GROWING ROD) (Akbarnia et al)

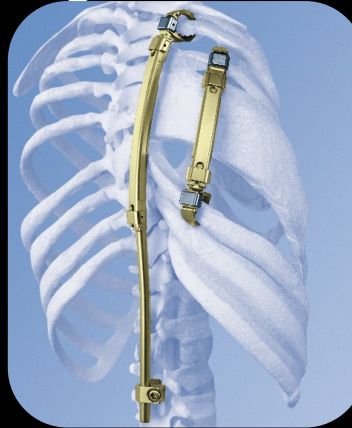
David Skaggs, M.D., Personal Communication: 2nd International Congress on Early Onset Scoliosis & Growing Spine (ICEOS) Montreal, Canada, November 7-8, 2008

# I SISTEMI ALLUNGABILI

- Si tratta di sistemi composti da barre metalliche non fisse, in grado di accompagnare il bambino nella sua crescita correggendo al tempo stesso la deformità
- Sino al trattamento di Artrodesi definitiva

2004

## La strumentazione allungabile in età pediatrica



Campbel propone il VEPTR (Vertbral Prosthetic Titanium Rib);

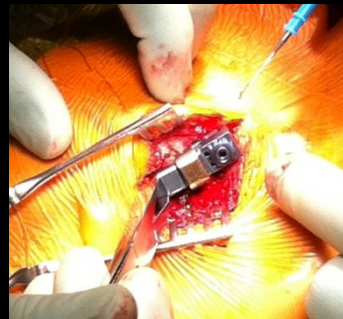
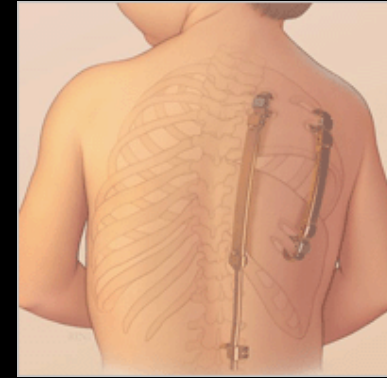
Progettato non tanto per la correzione della scoliosi, quanto per migliorata la capacità respiratoria del bambino durante l'età pediatrica

Le tecniche “Fusionless”

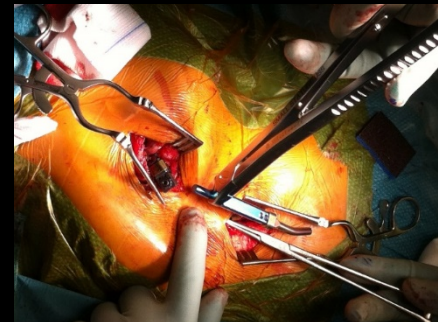
# VEPTR

Vertical Expandable Prosthetic Titanium Rib  
(VEPTR)

introdotto da Campbell e Smith nel 2004 per il trattamento della sindrome da insufficienza toracica (TIS) in associazione a scoliosi congenita e fusioni costali



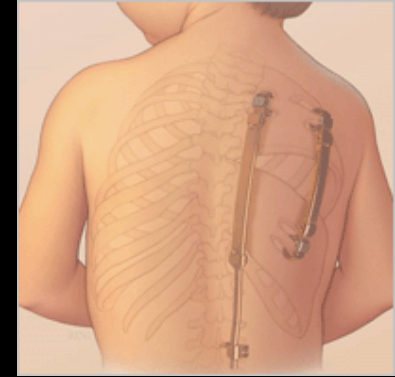
**Ancoraggio prossimale:  
uncino costale**



**Barra sottofasciale**

Le tecniche “Fusionless”

# VEPTR

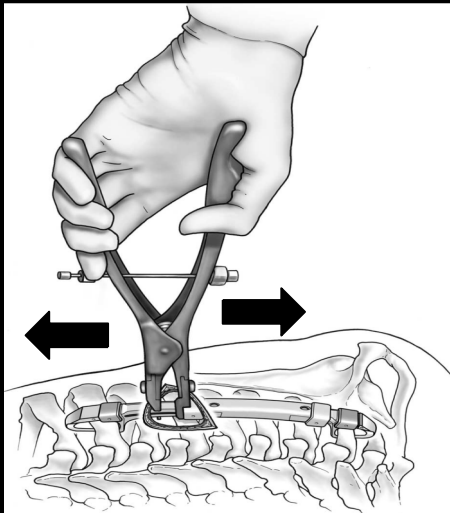


## INDICAZIONI

< 5 anni

Early onset scoliosis

Deformità severe toraciche



## ALLUNGAMENTI DEL SISTEMA

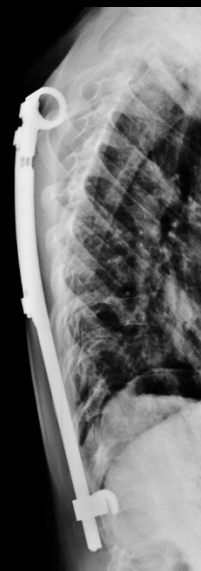
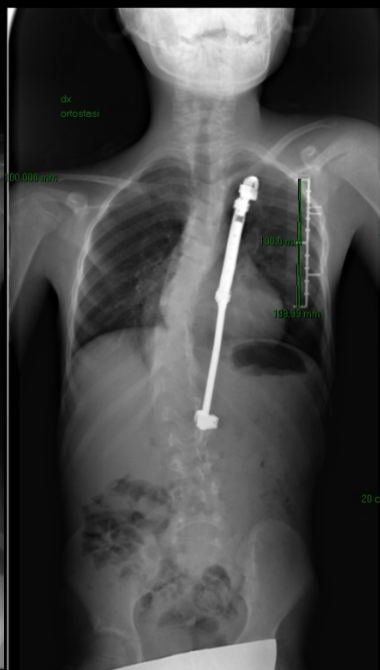
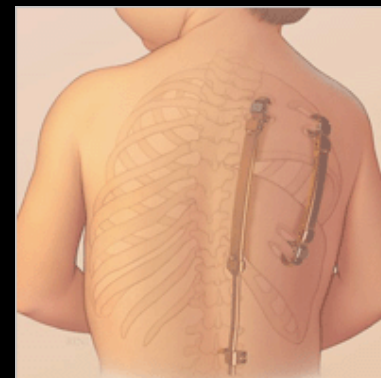
Ogni 6-8 mesi

Interventi in anestesia generale

Distrazione delle barre con apposito strumentario

# Le tecniche "Fusionless"

## VEPTR

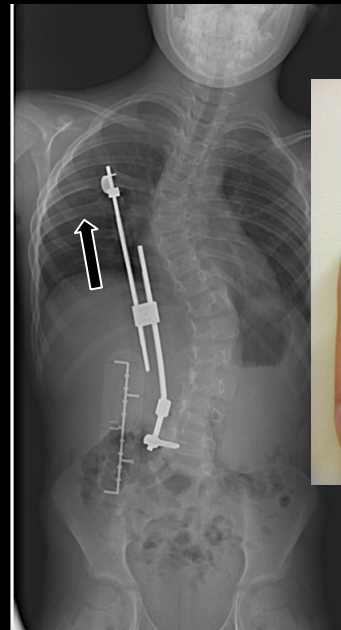


M 7 aa scoliosi idiopatica  
VEPTR

# Le tecniche “Fusionless” GSP

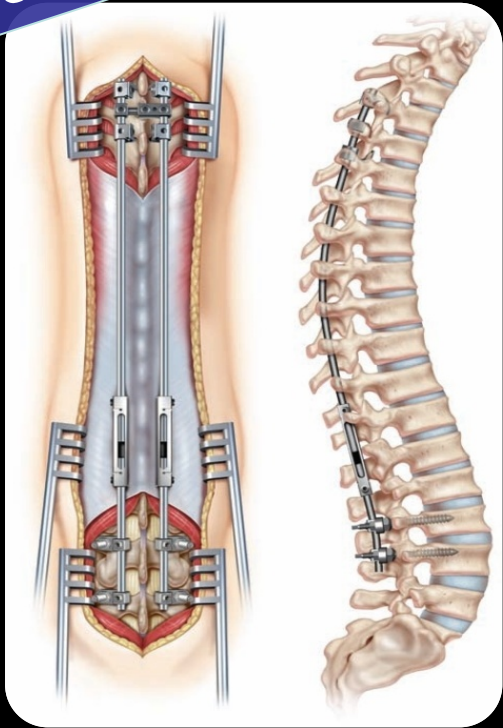
Altro sistema spino-costale

Aggancio prossimale con uncino costale e 2 barre connesse tra loro con un connettore che ne permette lo scorrimento nei 2 sensi



**SENZA  
FUSIONE**

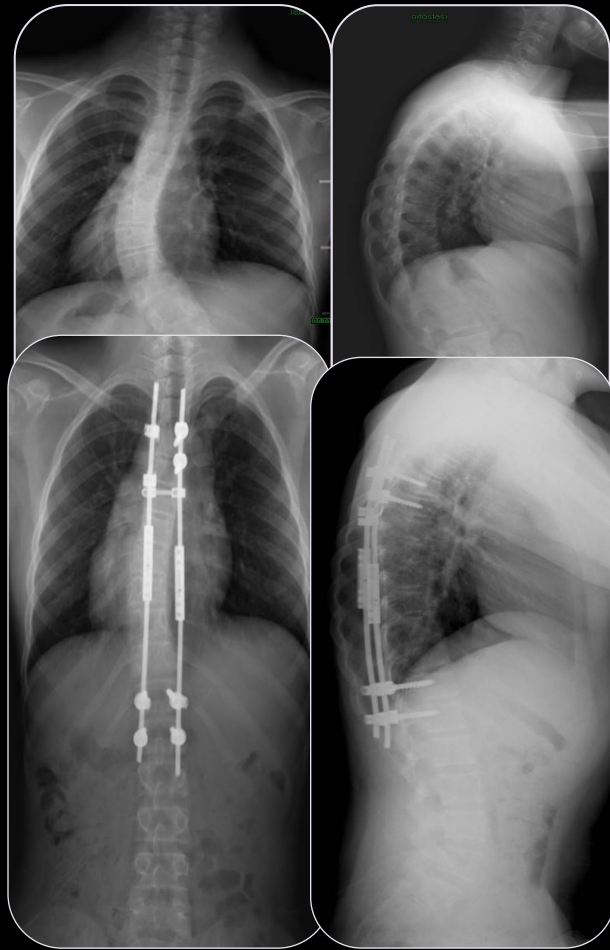
## DUAL GROWING ROD



**SISTEMA  
ALLUNGABILE**

5 anni in su  
vertebra-vertebra

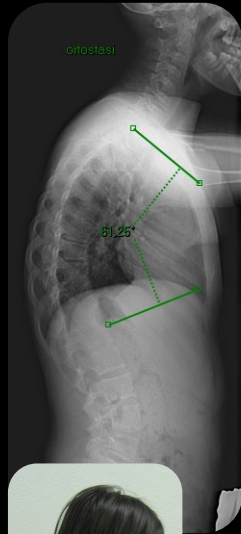
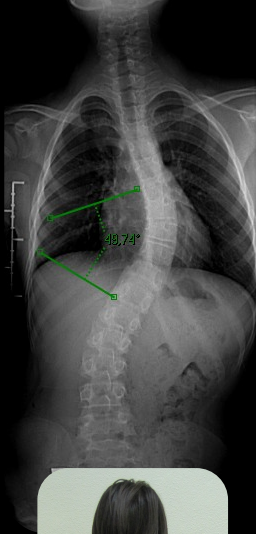
**Ingombrante**



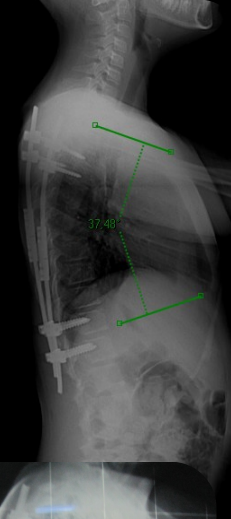
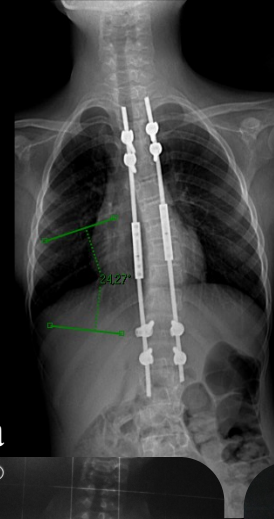
Scoliosi idiopatica  
infantile:

Riduzione della  
curva e  
mantenimento nel  
tempo

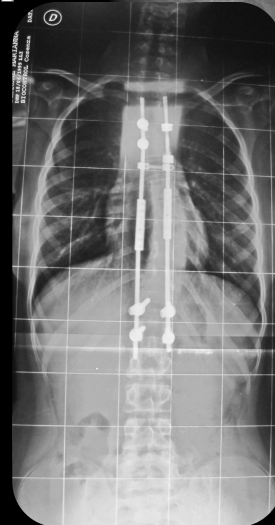
**7 anni, idiopatica, 50° Cobb**



**Dual Growing Rod, 24° Cobb**



**follow-up a  
11 anni,  
stabile**



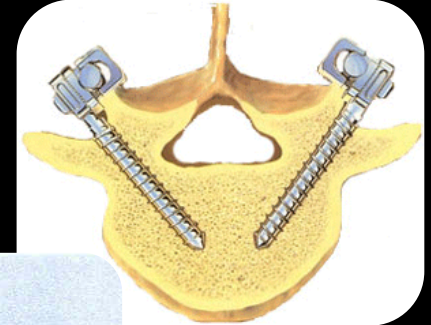
**In attesa  
intervento  
definitivo**

# Tecnica chirurgica:

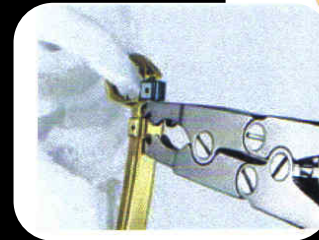
Incisione mininvasiva

Ancoraggio distale e prossimale

Barre sottofasciali



claw



Le tecniche “Fusionless”

# POST-OPERATORIO



Tutti i sistemi prevedono un trattamento con busto ortopedico solo diurno come protezione



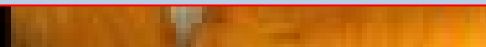


## GLI INTERVENTI DI ALLUNGAMENTO

- Ogni 6-8 mesi questi sistemi necessitano di un allungamento chirurgico per seguire la crescita del paziente
- Più sono ravvicinati gli interventi migliore è la correzione
- Incisione mininvasiva

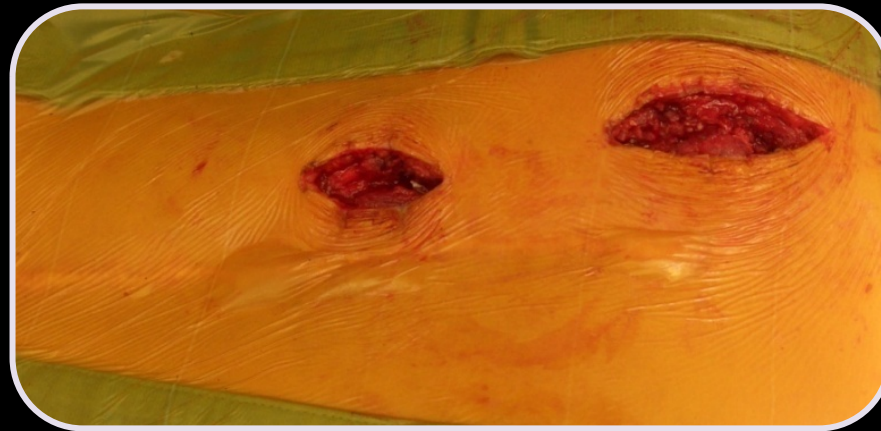


**SVANTAGGI:** numerosi interventi chirurgici in anestesia generale



## INDICAZIONI CORRENTI

- valore angolare della curva (40gradi)
  - sotto 10 anni
  - rigidità della curva
  - intolleranza al busto



# LE BAREE MAGNETICHE



Un controller esterno permette di individuare le barre dall'esterno e allungare lo strumentario quanto si desidera.

**Implant Complications After Magnetically-Controlled Growing Rods for Early Onset Scoliosis: A Multicenter Retrospective Review**

Edmund Choi MD, Brett Tetzley MD, Gregory Murdoch MD, Fiona Hesselet MD, Jeff Comstock BS, Ahmed Alstomy MD, Hsiao-Been MD, Kenneth Cheung MD, Gordon Densmore MD, John Ferguson MD, Tachia Craig MD, Ikko Hoshino MD, Guido La Rosa MD, Apostol Serkizky MD, Berthold Altzinger MD

**INTRODUCTION:**  
Traditional growing rods have a reported wound and implant complication rate as high as 58%. It is unclear whether the use of MCGR will affect this rate. This study was performed to characterize surgical complications following MCGR in early onset scoliosis (EOS).

**METHODS:**  
• Multicenter retrospective review of MCGR cases.  
• Inclusion criteria were:  
1) diagnosis of EOS of any etiology  
2) less than 10 years and younger at time of diagnosis  
3) pre-op major curve size >30 degrees  
4) pre-operative thoracic spine height <22cm  
• Complications were categorized as wound-related and implant-related.  
• Complications were also classified as early (<6 months from index surgery) versus late (>6 months).

**RESULTS:**  
• 54 MCGR patients met inclusion criteria.  
• Mean age at initial surgery was 7.3 years (range 2.4 to 11 years), and mean duration of follow-up was 19.4 months (10-7.9).  
• There were 30 primary and 24 conversion procedures.  
• Twenty-one (38.9%) of 54 patients had at least one complication.  
• Fifteen (27.8%) had at least one revision surgery.  
• Breakdown of results is presented in the table.

| Implant related complications                            |                           |
|--|---------------------------|
| Failure of lengthening requiring revision surgery (2/54) | 4.5 mm rod diameter (2/6) |
| Rod breakage (6/54)                                      | 5.5 mm rod diameter (4/6) |
|  | Early complication (2/6)  |
|  | Late complication (4/6)   |
| Other* (7/54)  | Primary cases (3/7)       |
|  | Conversion cases (4/7)    |

**Wound related complications**

|                                |                                      |
|--------------------------------|--------------------------------------|
| Surgical site infection (2/54) | Treated with oral antibiotics (1/2)  |
|                                | Rod removal and IV antibiotics (1/2) |

\*Pneumonia, urinary tract infection, cellulitis, or wound dehiscence.

**CONCLUSIONS:**  
• This study shows that compared to traditional growing rods, MCGR had a lower infection rate based on previously published studies.  
• MCGR does not appear to prevent common implant-related complications of EOS such as rod or foundation failure. The long-term implication remains to be determined.

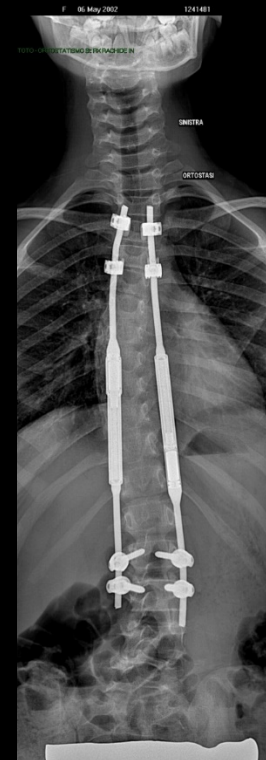
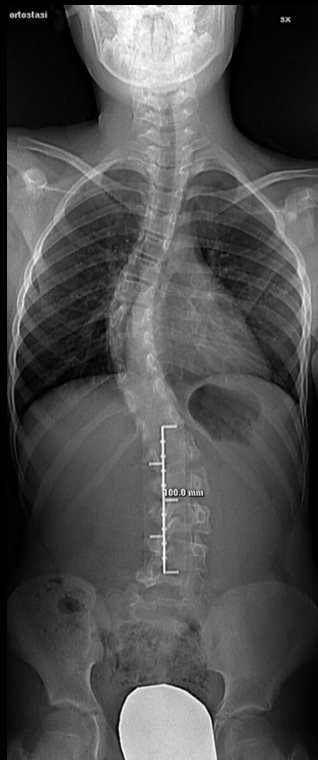
## VANTAGGI:

- Nessun ulteriore intervento
- Nessuna anestesia generale
- Regime di ricovero DS

A.M.

F, Anni 9

Scoliosi idiopatica evolutiva ad esordio precoce con  
Spondilolistesi L5-S1 istmica di I grado

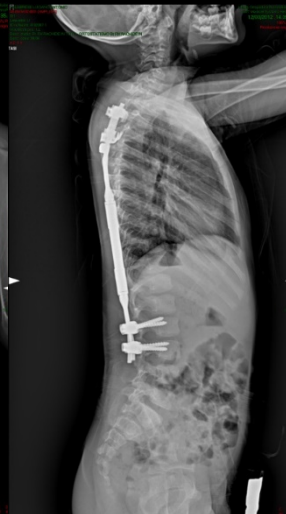
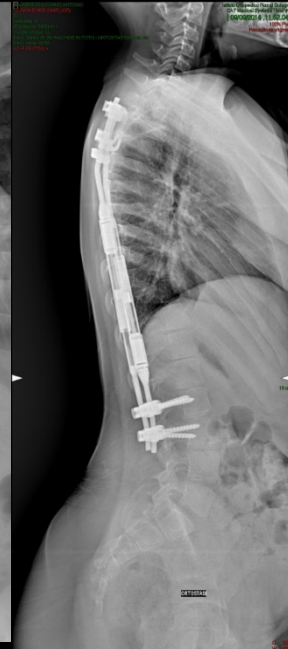
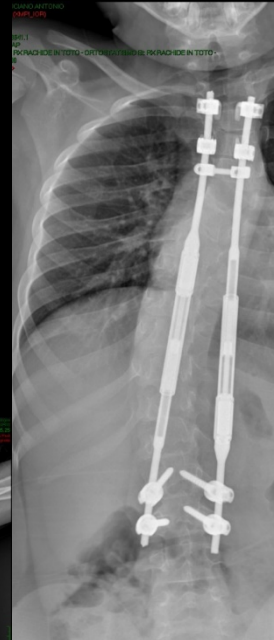




M : infantile idiopathic scoliosis

7 YY

Post-op

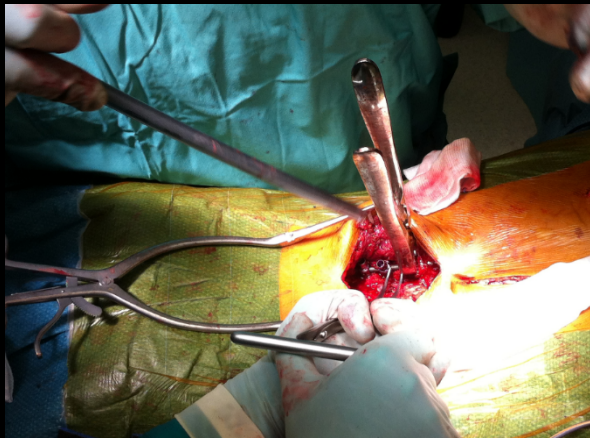


Last lengthening: 11°  
Tot: + 30 R e + 24 L

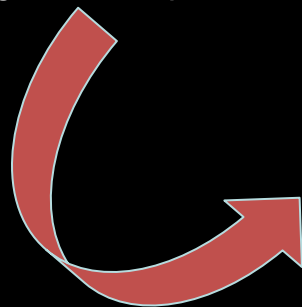
# Controllo Ecografico degli allungamenti



# ALLUNGAMENTI



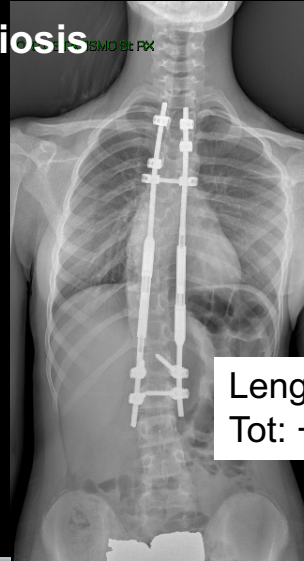
5 giorni in ospedale



Pochi minuti in ambulatorio



# F 9 yy: juvenile idiopathic scoliosis

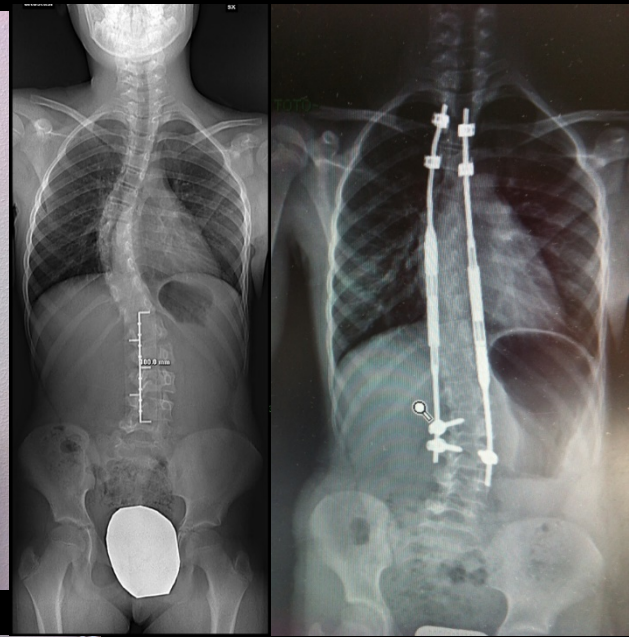


Lengthening: 9°  
Tot: +18 R e + 14 L



# Results

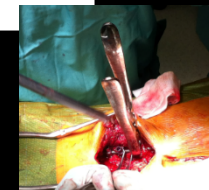
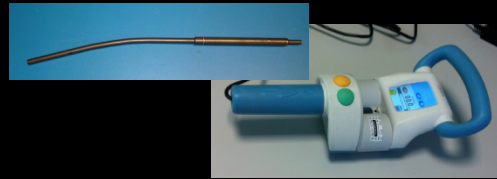
F 9 yy: juvenile idiopathic scoliosis



Last lengthening: 12°  
Tot: + 35 R e + 32 L

# Costi €

|              | MCGR  | TRADIZIONALI |
|--------------|-------|--------------|
| 1° impianto  | 27000 | 10500        |
| allungamenti | 300   | 4200         |



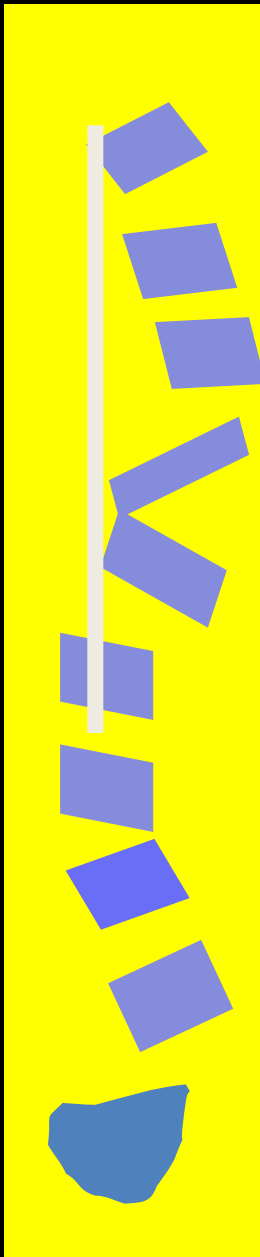
*Although MCGR instrumentation costs more (HK\$50 000; US\$6451) than does the traditional growing rod (HK\$25 000; US\$3225), the **traditional procedure is associated with further costs due to frequent operations, spinal cord monitoring, use of general anaesthesia, hospital stays, drug use, manpower, consumables, and time off work for the parents.***

Magnetically controlled growing rods for severe spinal curvature in young children: a prospective case series.  
[Cheung KM](#), [Cheung JP](#), [Samartzis D](#), [Mak KC](#), [Wong YW](#), [Cheung WY](#), [Akbarnia BA](#), [Luk KD](#).  
*Lancet*. 2012 May 26

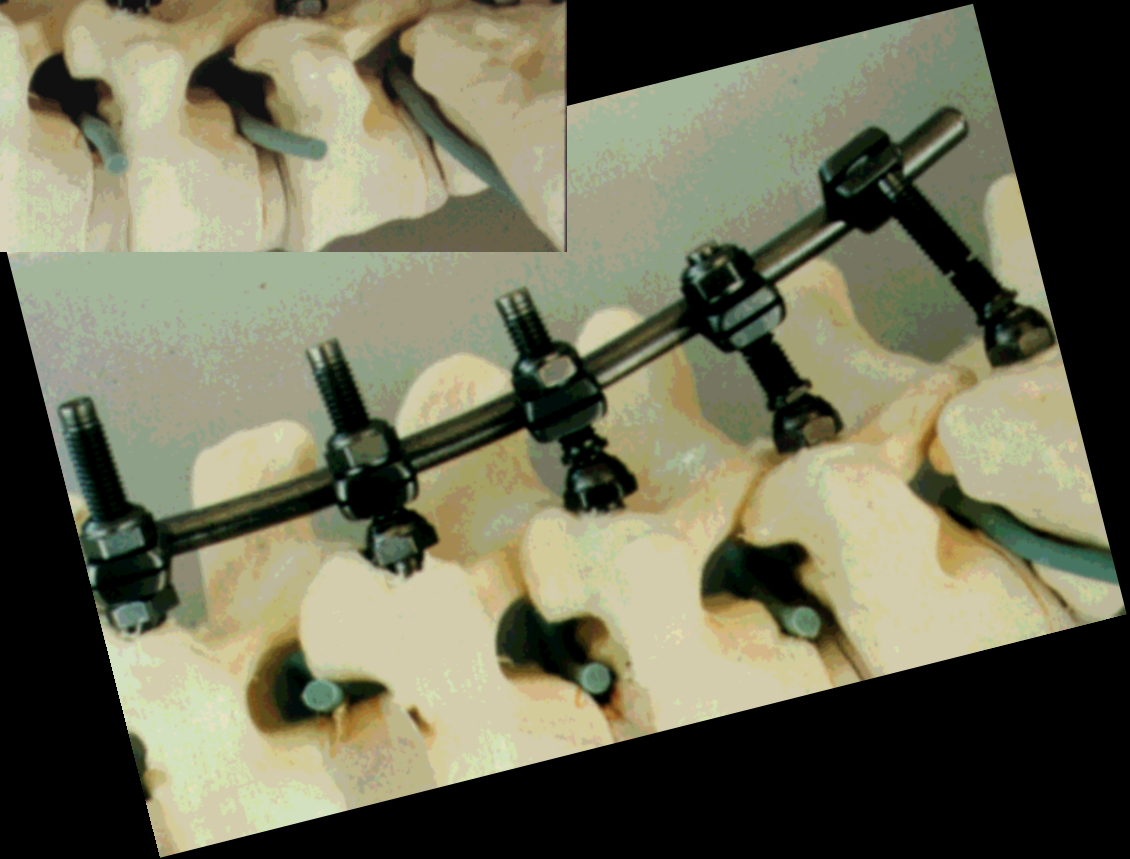
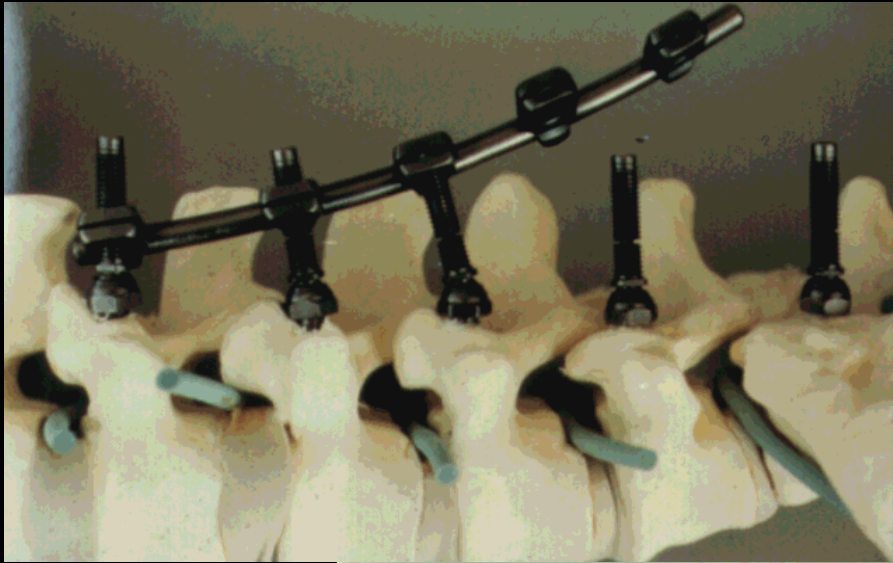
Dopo 3 anni circa i costi si pareggiano

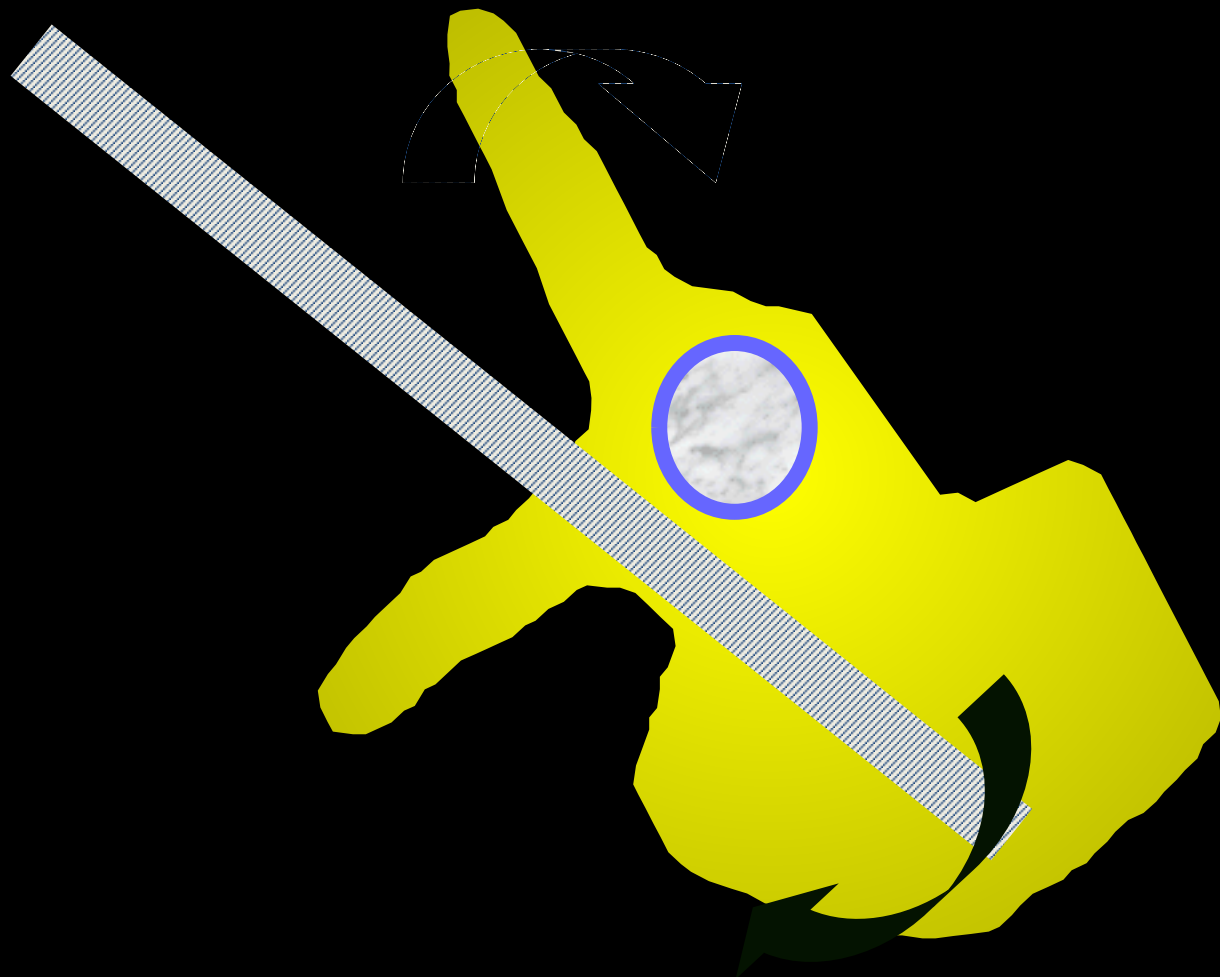
# Chirurgia Posteriore

- **Infanzia:** tempi chirurgici successivi sino alla correzione definitiva (artrodesi strumentata)
- **Adolescenza:** Correzione definitiva in un tempo unico (artrodesi strumentata)
- **Adolescenza, scoliosi severa.** Correzione in due tempi chirurgici



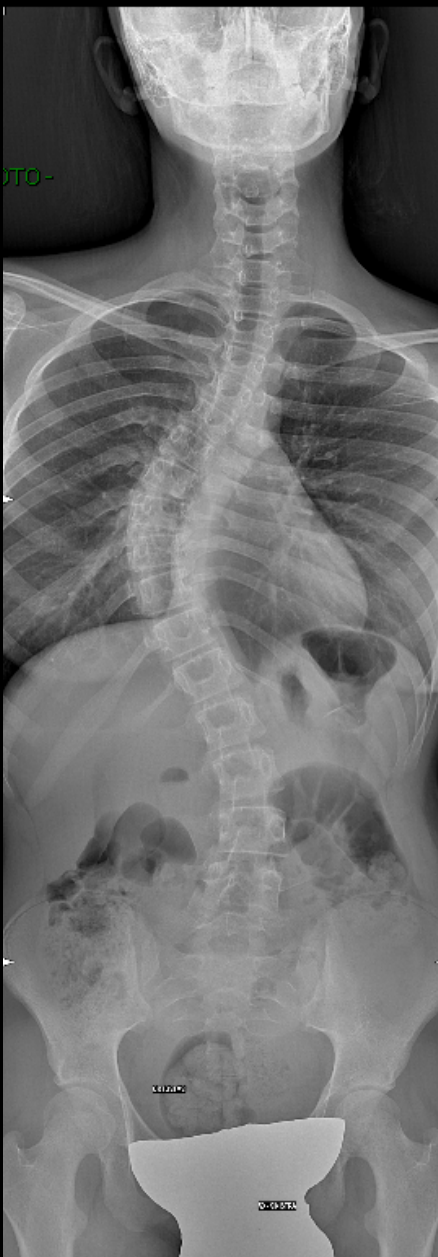
- **Adolescenza:** Correzione definitiva in un tempo unico  
(artrodesi strumentata)



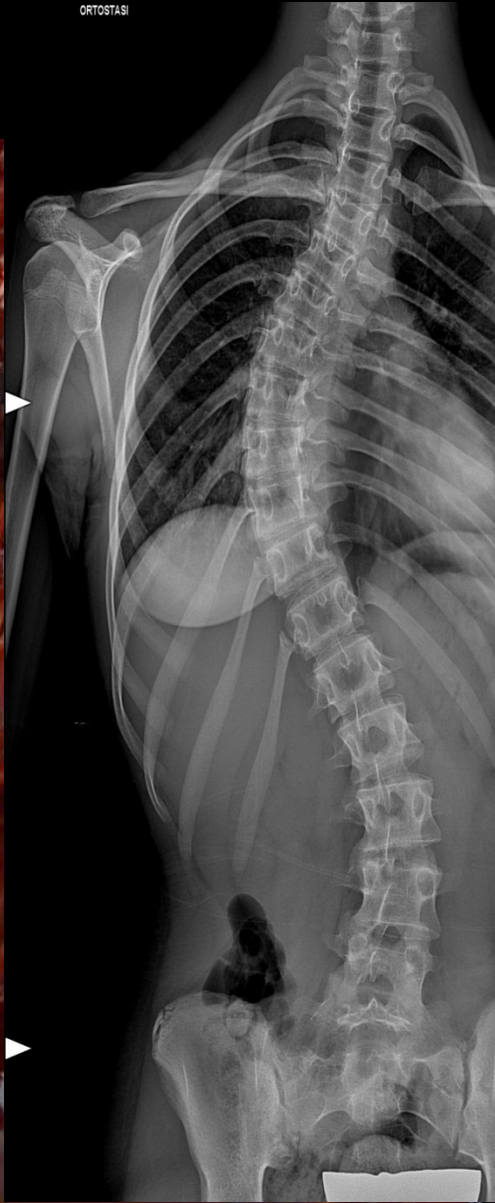




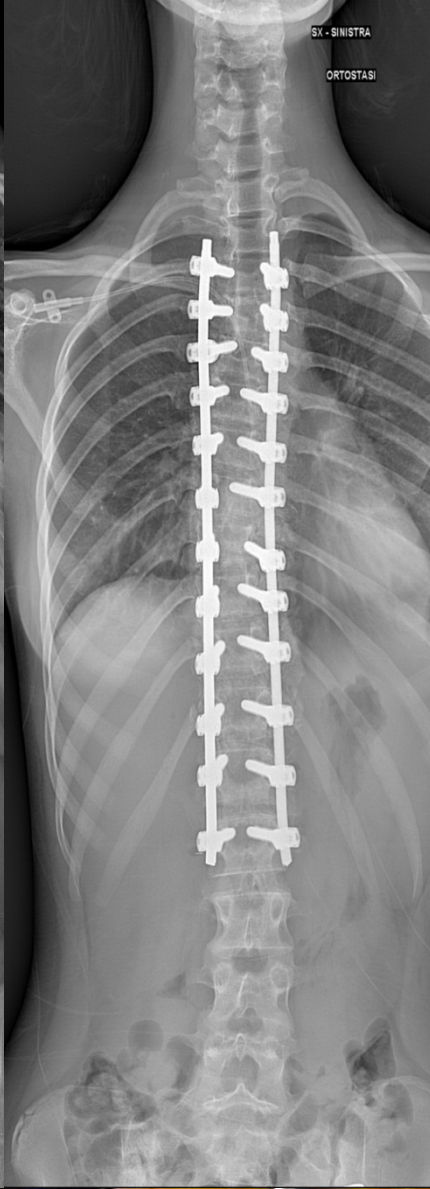
- Correzione delle deformità e un serraggio brevettato "a d
- Profilo più basso disponibile sul mercato



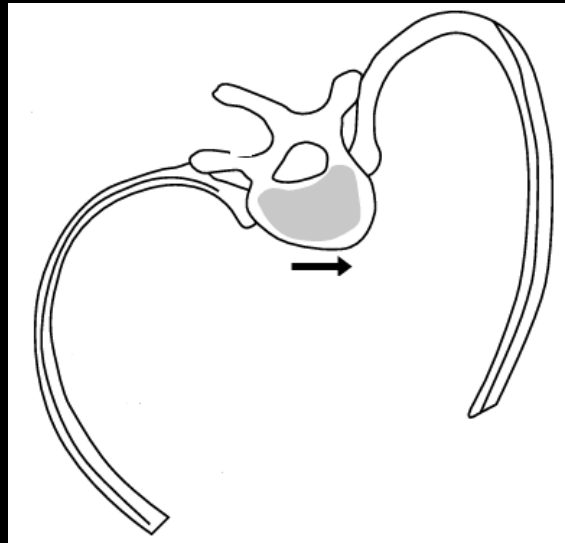
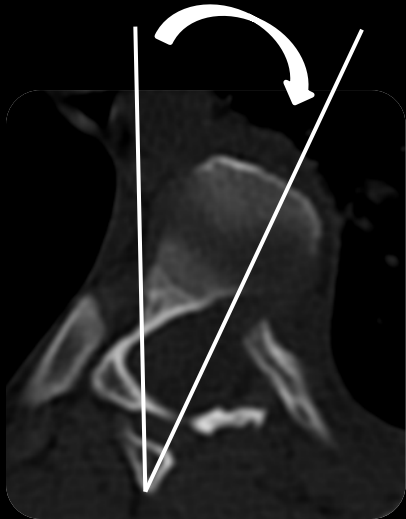
ORTOSTASI



SX - SINISTRA  
ORTOSTASI

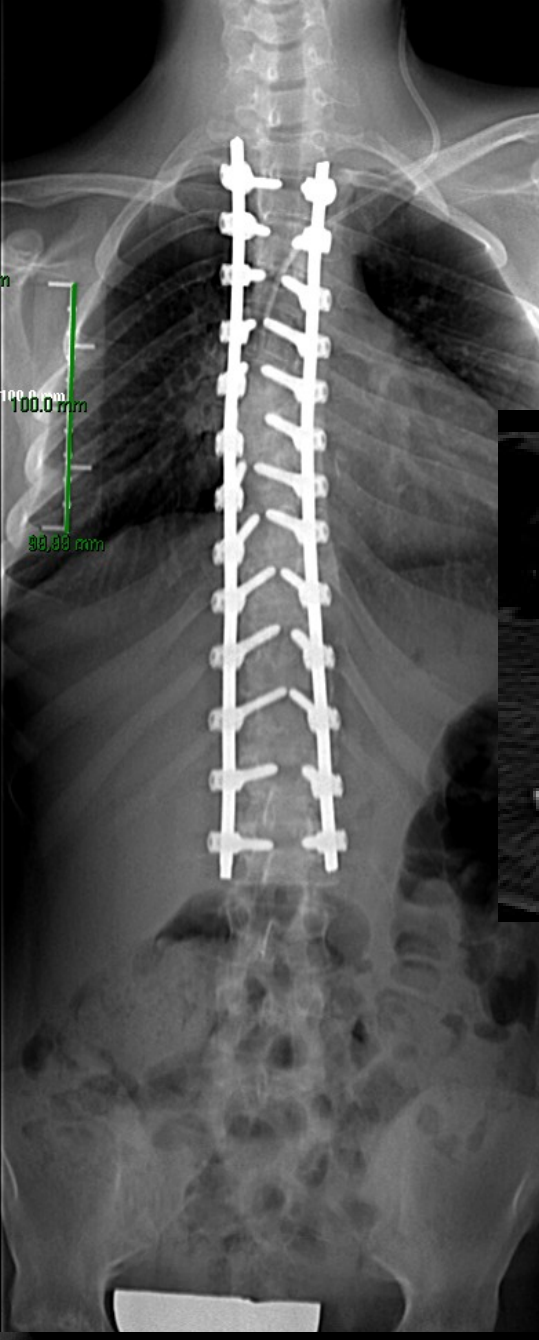


**Adolescenza.** Correzione definitiva in un tempo unico  
Oltre alla scoliosi viene corretta la rotazione vertebrale



H. PETRO GILDA  
31/11/2011  
Lunetta (L)  
ID richiesta: 4133882  
Inviata il giorno 05/11/2011  
Data: sabato, 5 novembre 2011  
Data: sabato 05/11/2011  
41/19

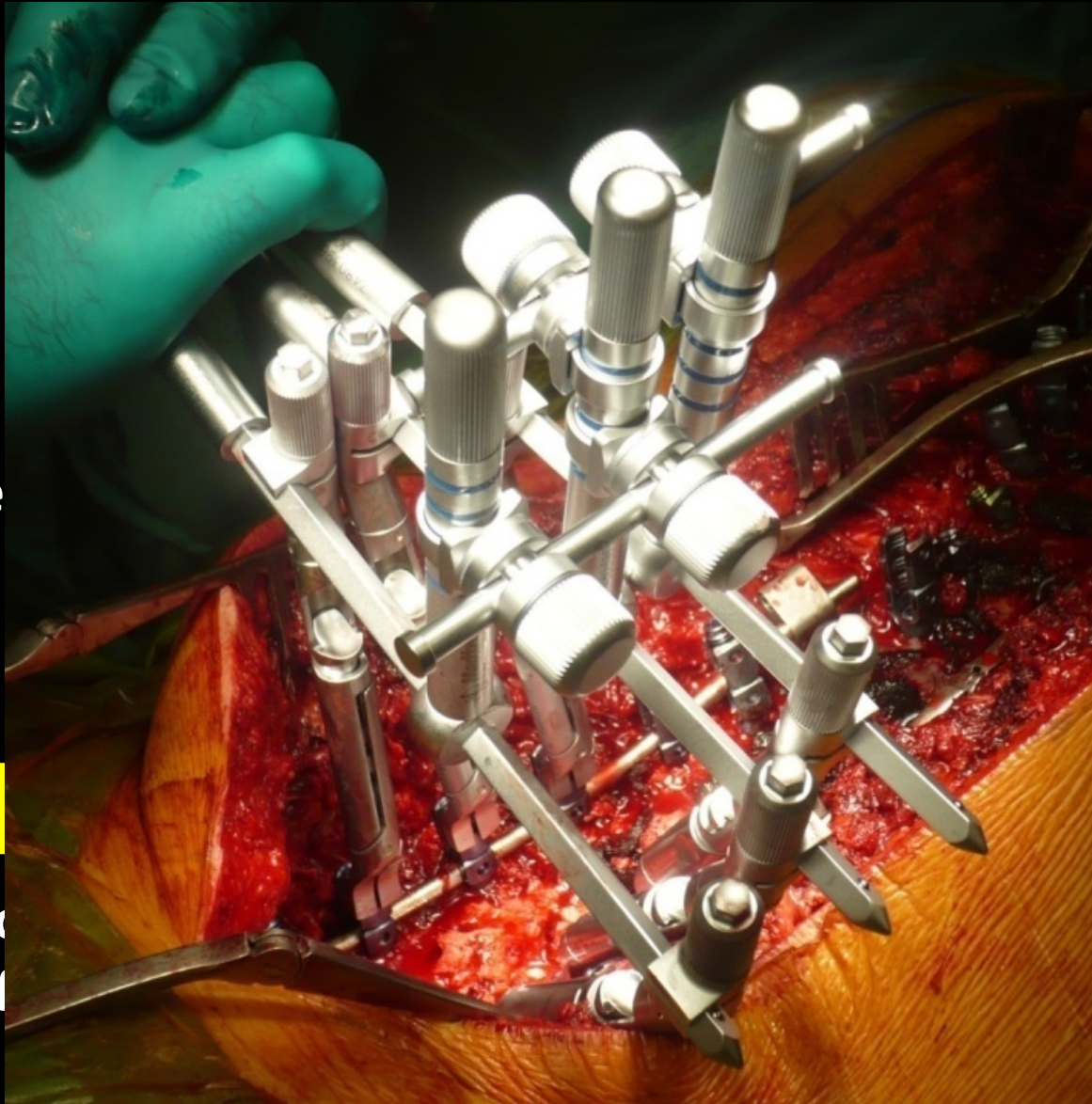
INTRA OPERATORIO  
CAT Medical  
13/04





# Derotazione Vertebrale Diretta

Rivoluzione  
...adottata



007

1. Migliore Co
2. Migliore Eff

Scoliosi

# La Derotazione Diretta è efficace ? **Si**

**Lee, Suk**

**42.5**

**%**

**Vallespir**

**56**

Eur Spine J (2013) 22:313–323  
DOI 10.1007/s00586-012-2372-2

ORIGINAL ARTICLE

**Apical vertebral derotation in the posterior treatment of adolescent idiopathic scoliosis: myth or reality?**

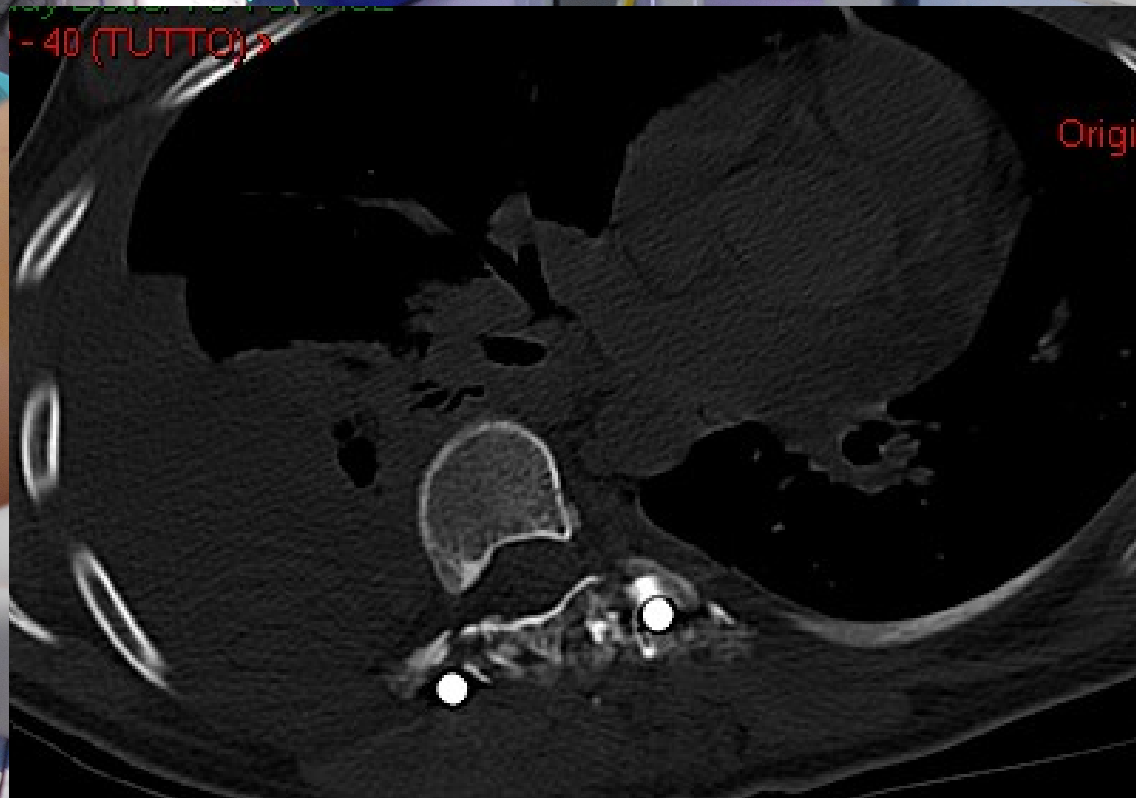
Mario Di Silvestre · Francesco Lolli ·  
Georgios Bakaloudis · Elena Maredi ·  
Francesco Vommaro · Francesca Pastorelli

**Di Silvestre**

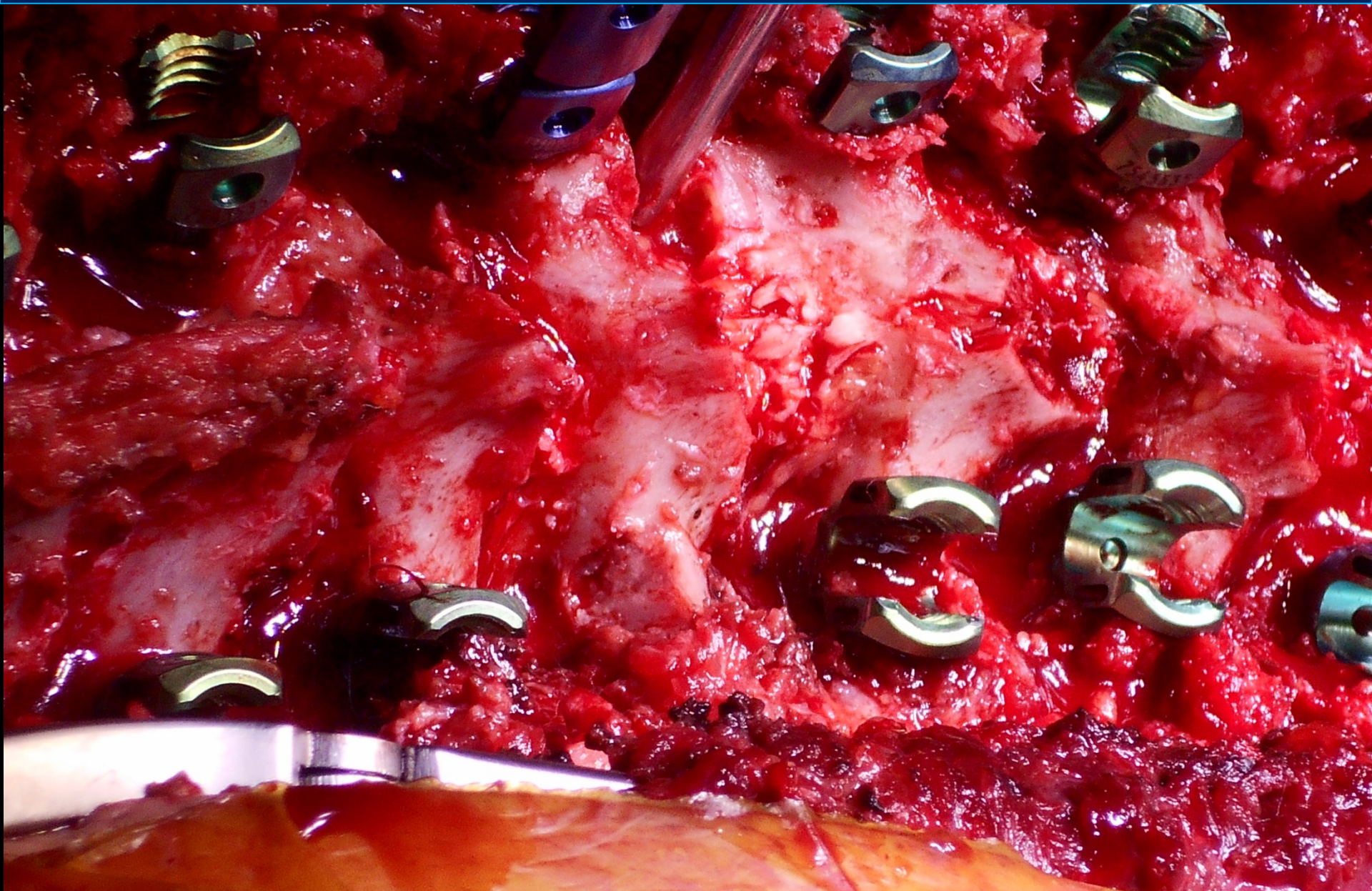
**63.4**

# Derotazione Diretta : Come? I punti fermi

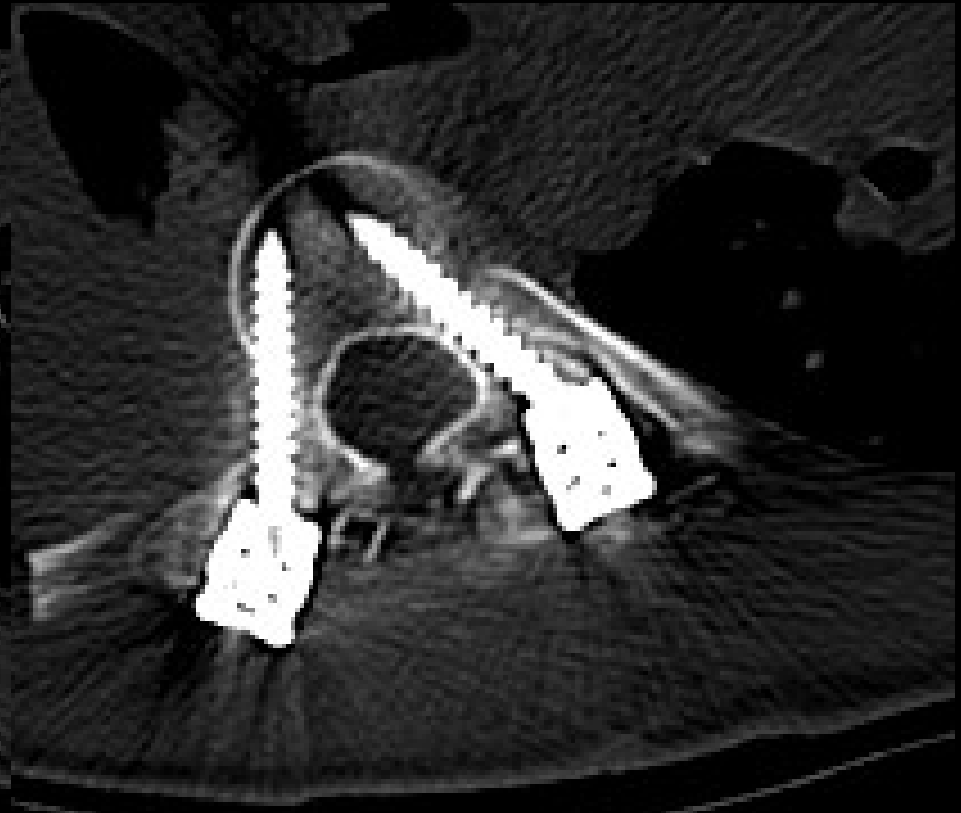
Derotazione per NON fare Toracoplastica



# Viti Monoassiali con alta densità



**NO Viti Poliassiali perchè inefficaci**  
**Molte reserve sulle viti UNIPLANARI**



### 3. Osteotomia di Ponte

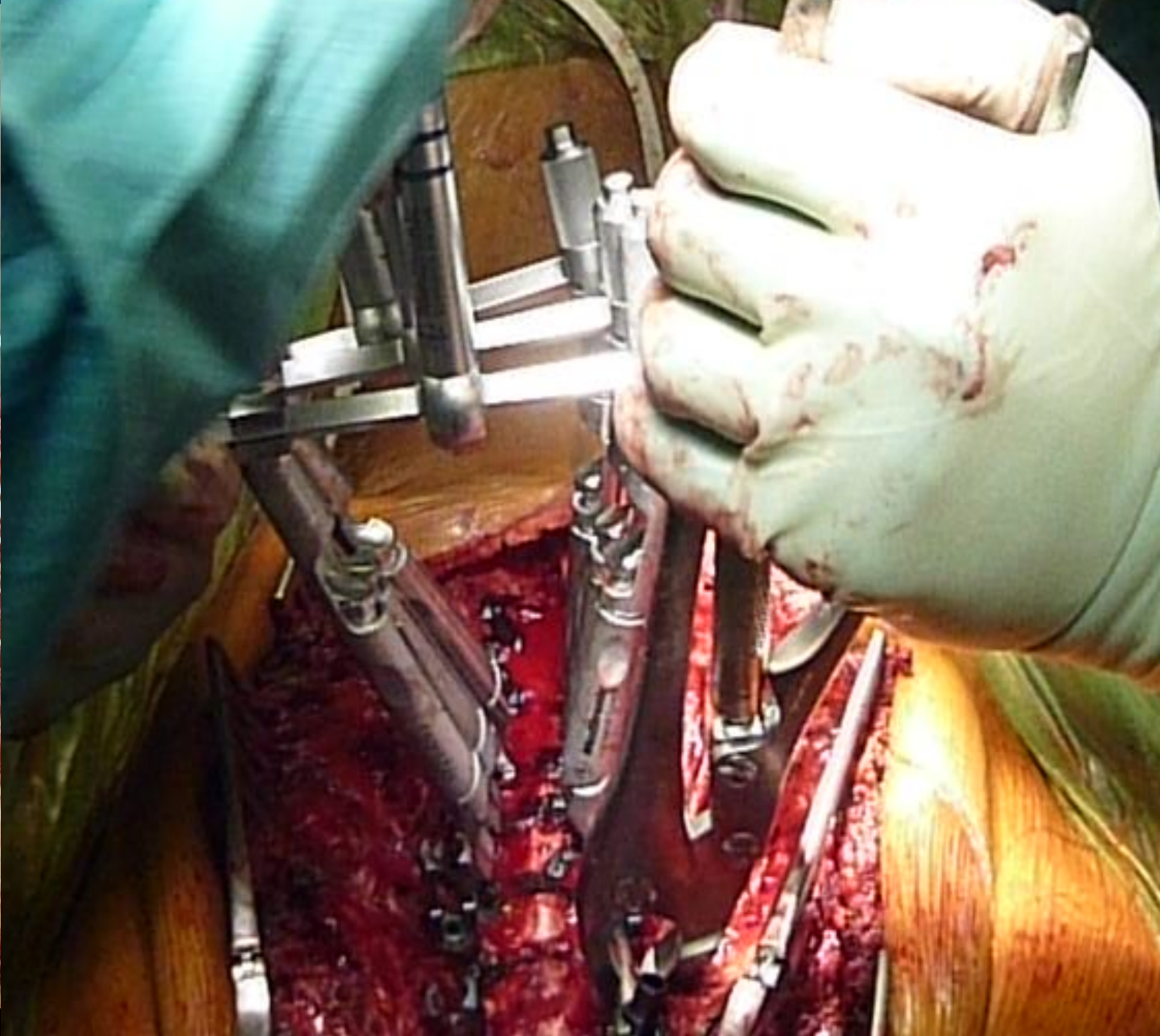
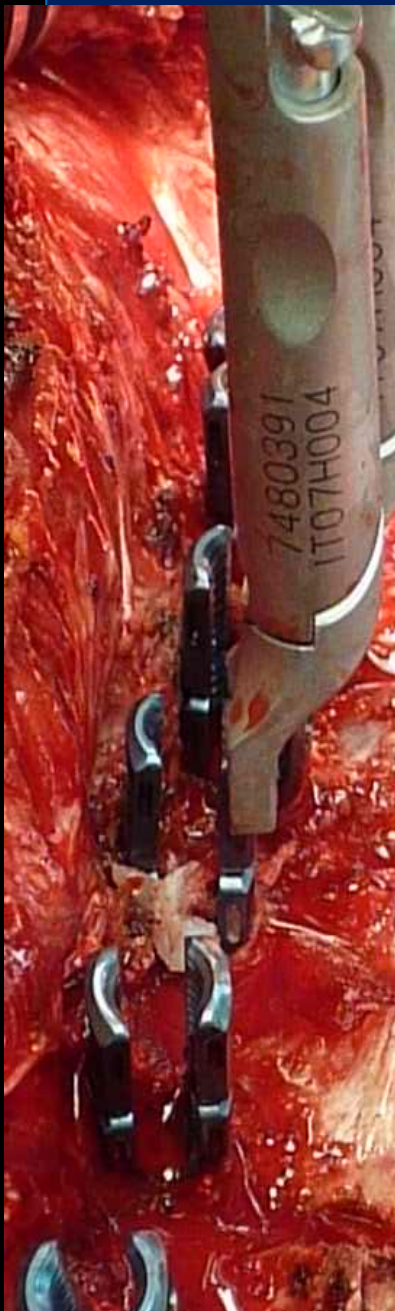


## 4. Release aggressivo



## 5. Barra Rigide (Cromo-Cobalto)



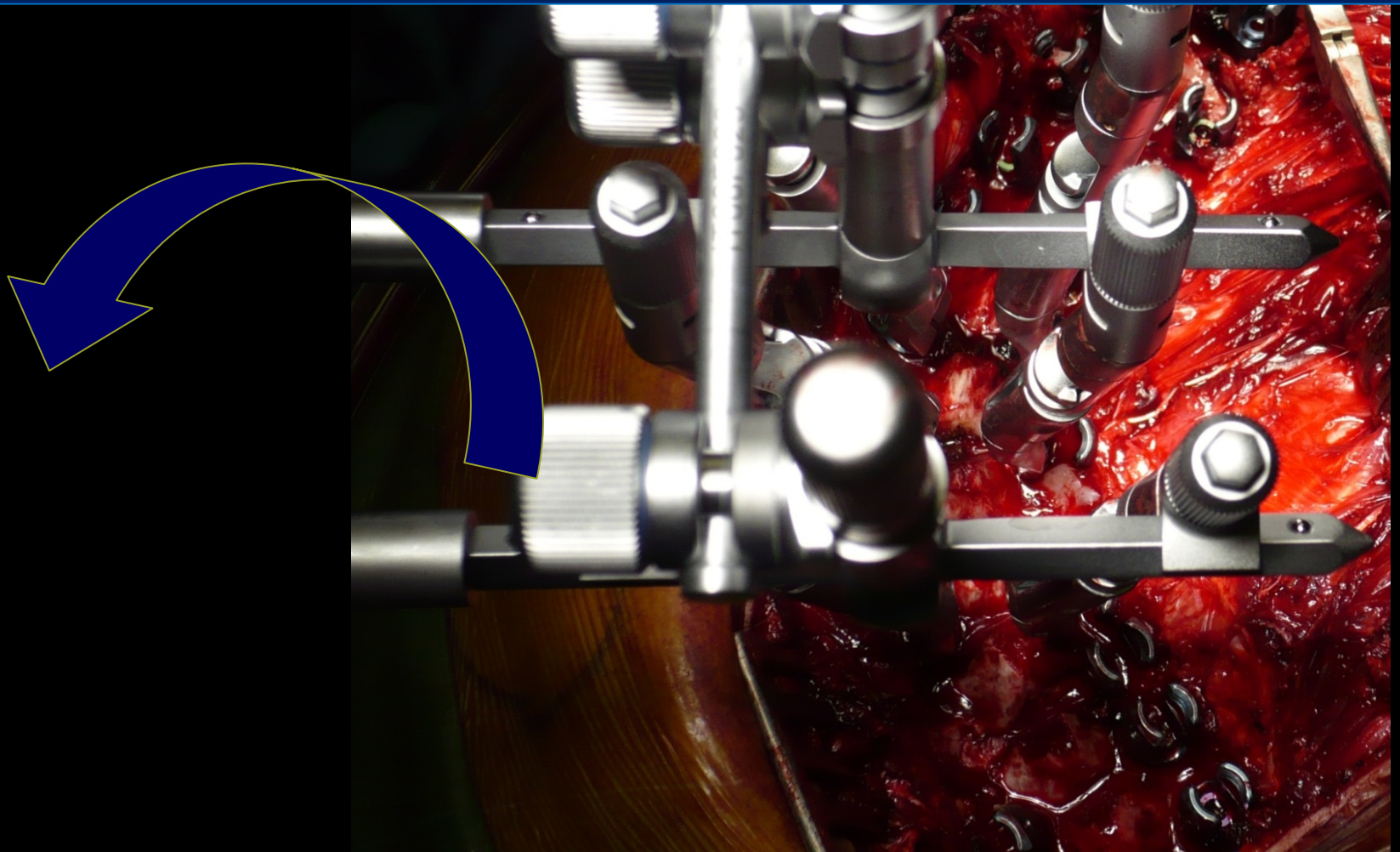


# Derotazione Convessa

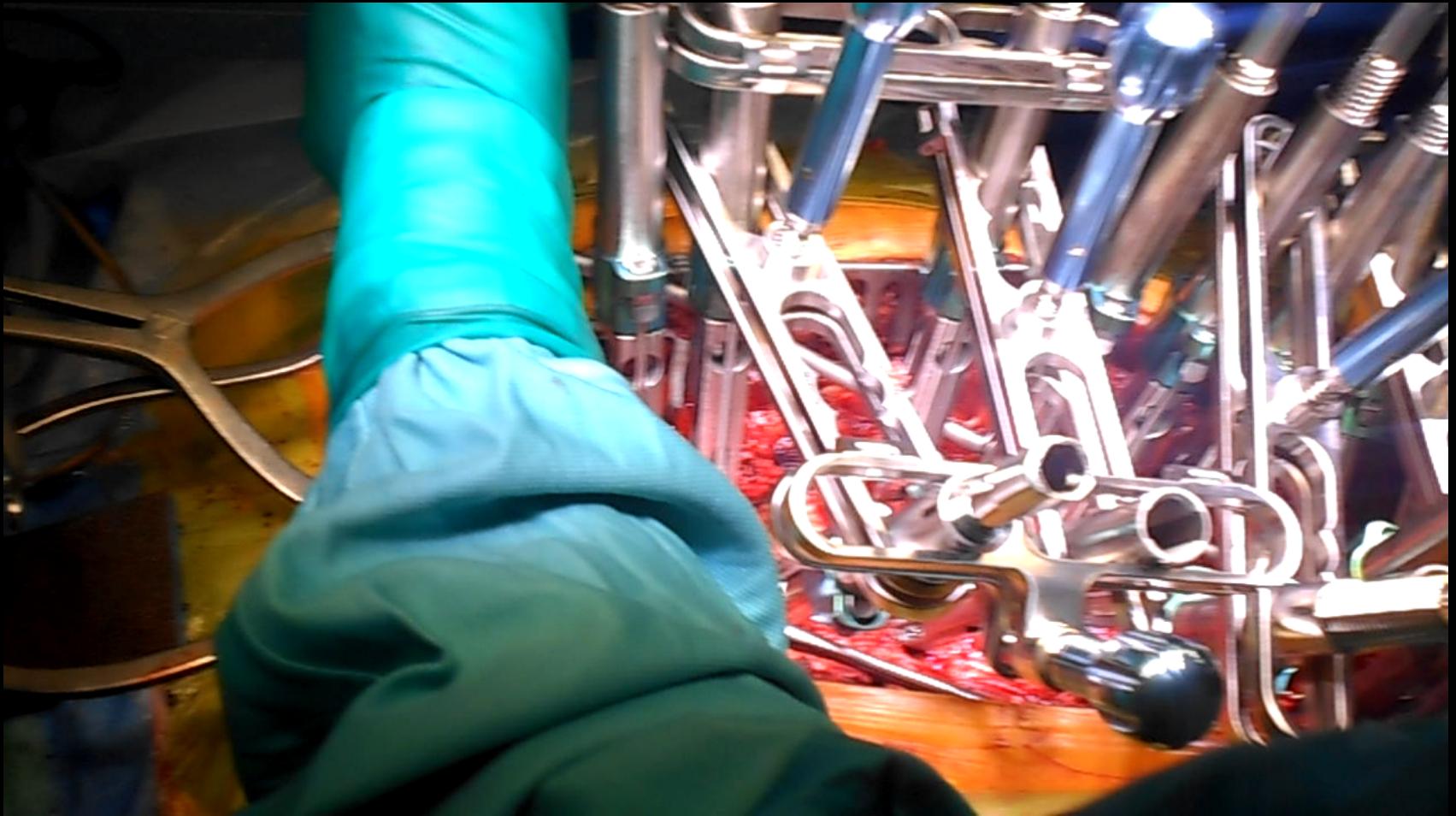
1. Senza barre
2. Inserimento barra convessa, non serrata
3. Inserimento barra concava, non serrata
4. Avvicinamento e Serraggio delle barre
5. Ripresa della Derotazione allentando i dadi
6. Serraggio definitivo

**30 minuti**

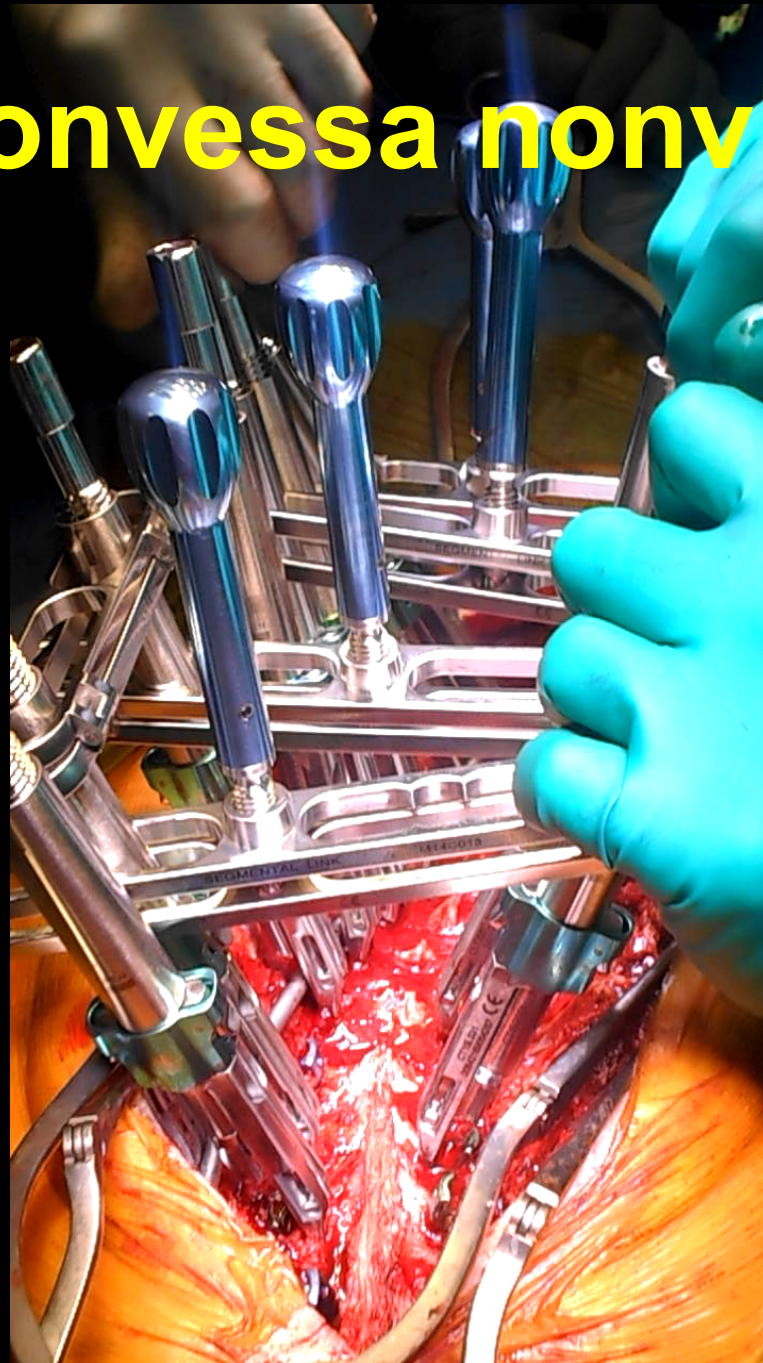
**Derotazione sulla CONVESSITA'**  
**prima SENZA barre poi su barra CONVESSA lunga**



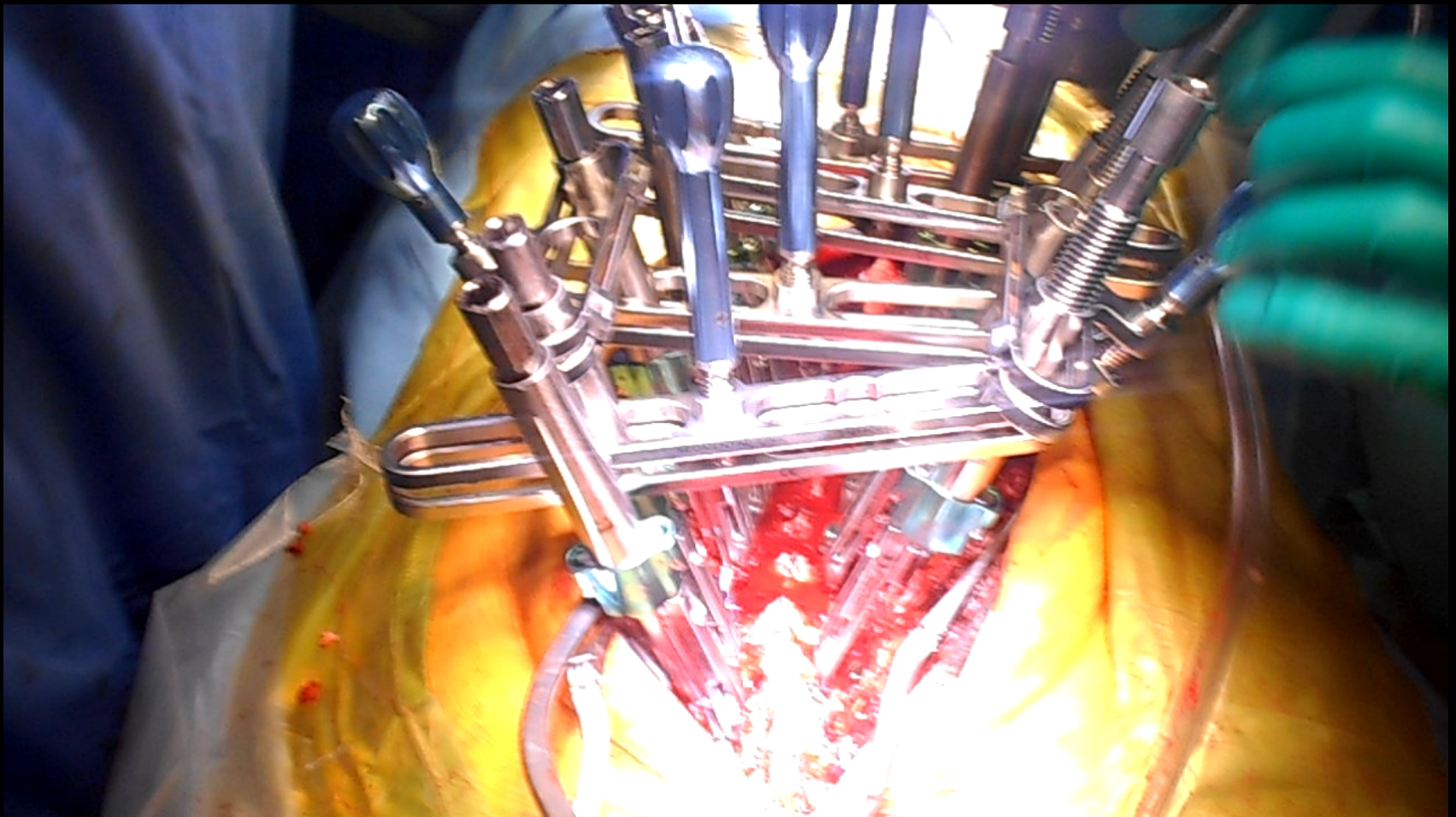
# Derotazione, **SENZA BARRE**



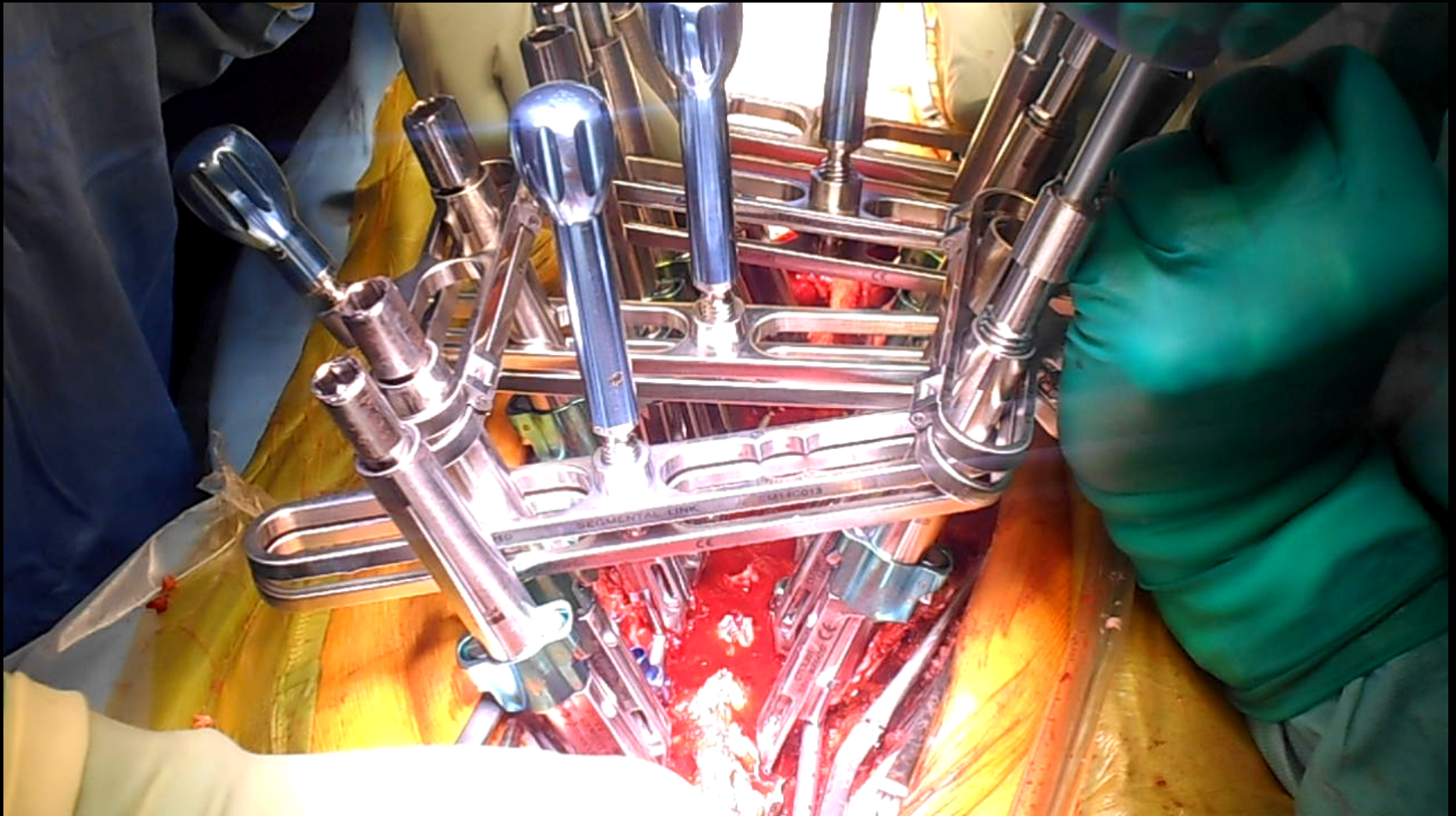
# Barra Convessa nonvincolata



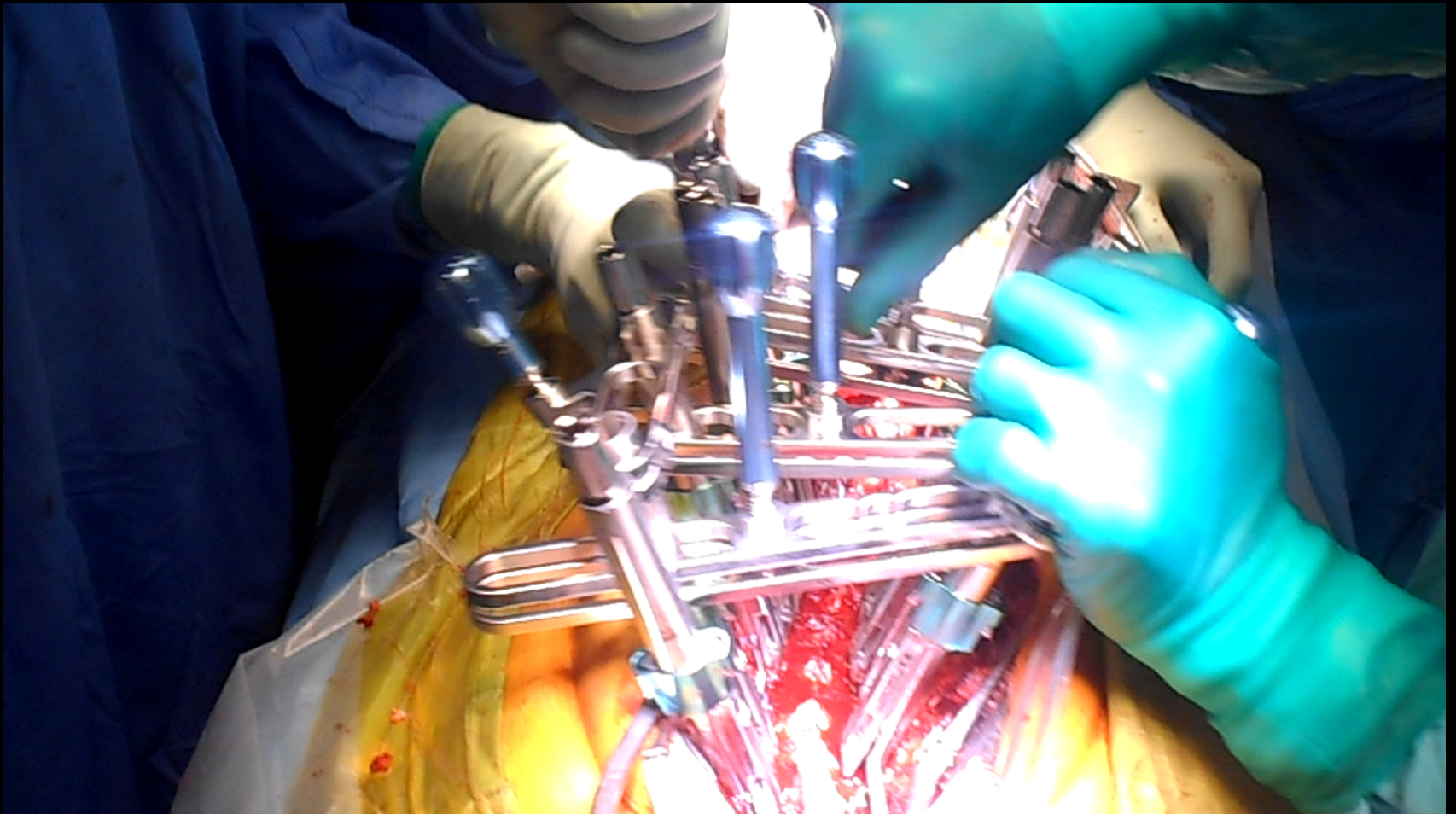
# Avvicinamento della barra Convessa non serrata / Applicazione barra Concava



# Avvicinamento barra concava



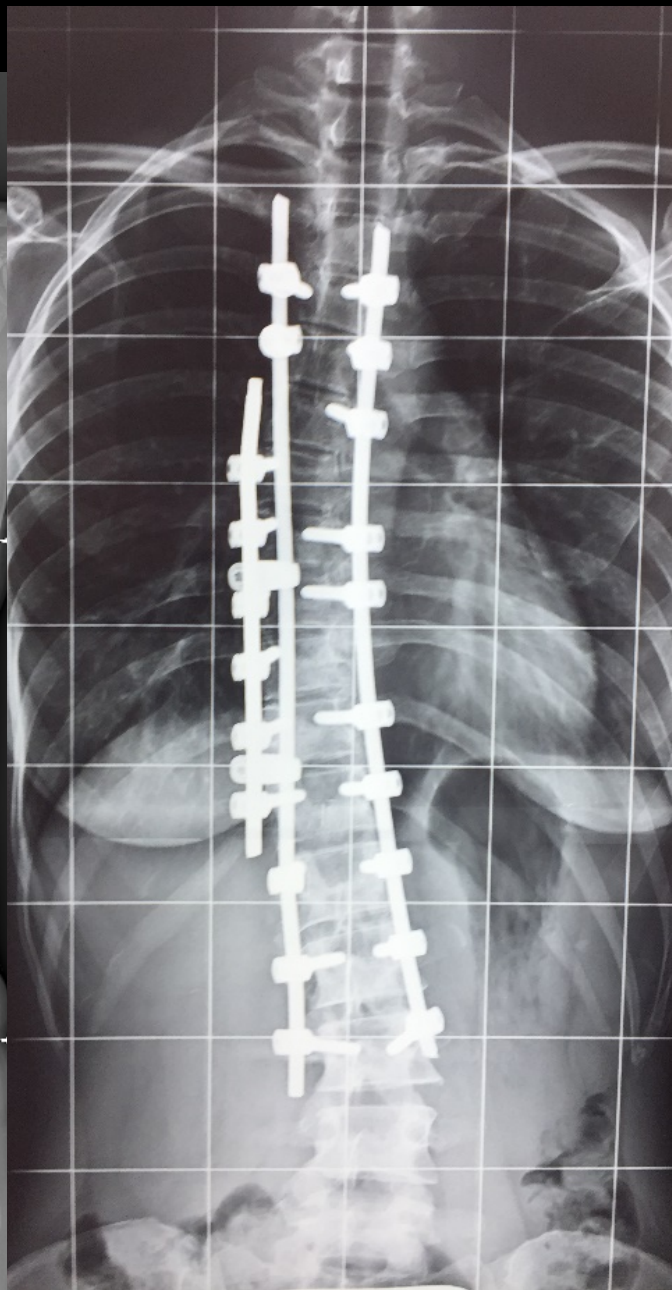
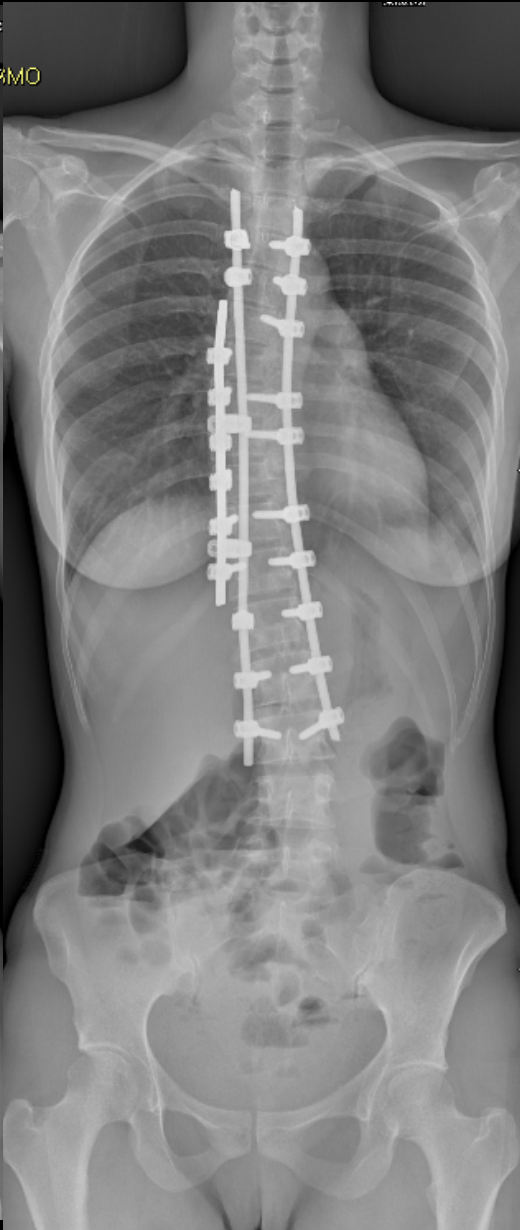
# Derotazione finale e serraggio



# Derotazione CONVESSA

barra corta convessa su vertebre apicali  
costruito a 3 barre

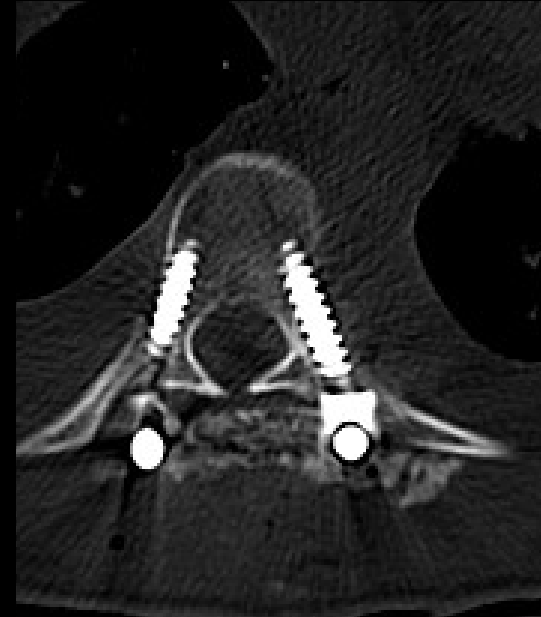






## Vantaggi della Derotazione Diretta

1. **Correzione della Rotazione Vertebrale e della Scoliosi**
2. **Effetto Estetico (senza toracoplastica)**



# Chirurgia Posteriore

- **Infanzia:** tempi chirurgici successivi sino alla correzione definitiva (artrodesi strumentata)
- **Adolescenza:** Correzione definitiva in un tempo unico (artrodesi strumentata)
- **Adolescenza, scoliosi severa.** Correzione in due tempi

# Scoliosi Severe

Chirurgia combinata abbandonata

Chirurgia posteriore largamente adottata.

- Rischiosa la VCResection.
- Meno rischiosa correzione posteriore con osteotomie di Ponte aggressive.
- Rischiosa una correzione d'embloè





## Trazione halo prima della correzione posteriore

- Svantaggi: piuttosto invasiva, dove problemi di intolleranza, sofferenza
- Eccessiva trazione sul rachide cerv

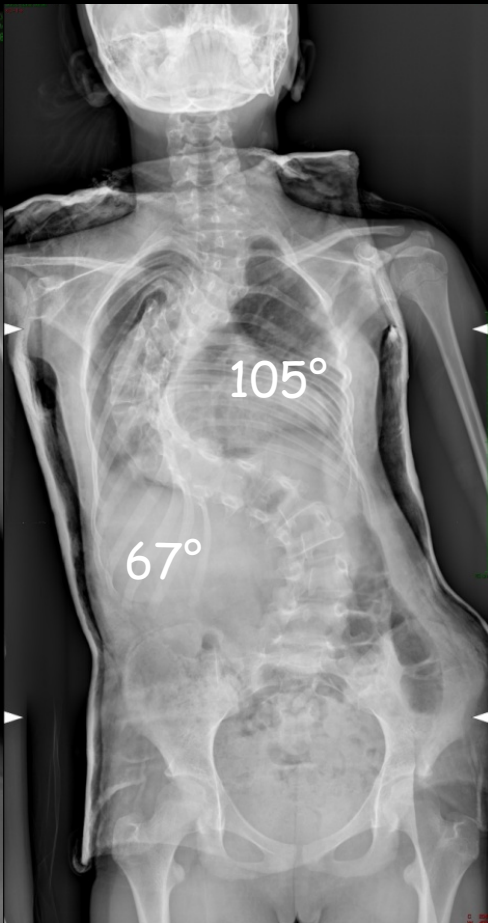
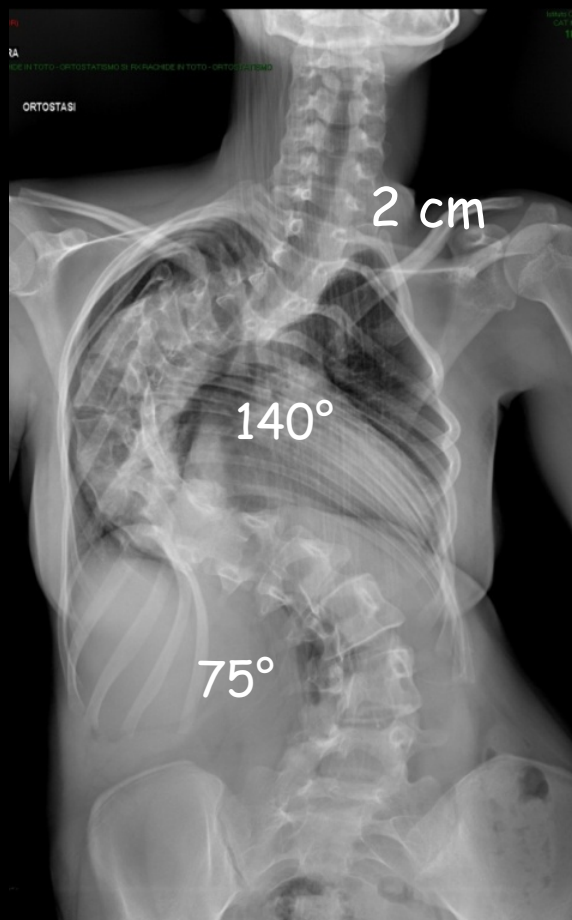


# Trazione Halo-preoperatoria



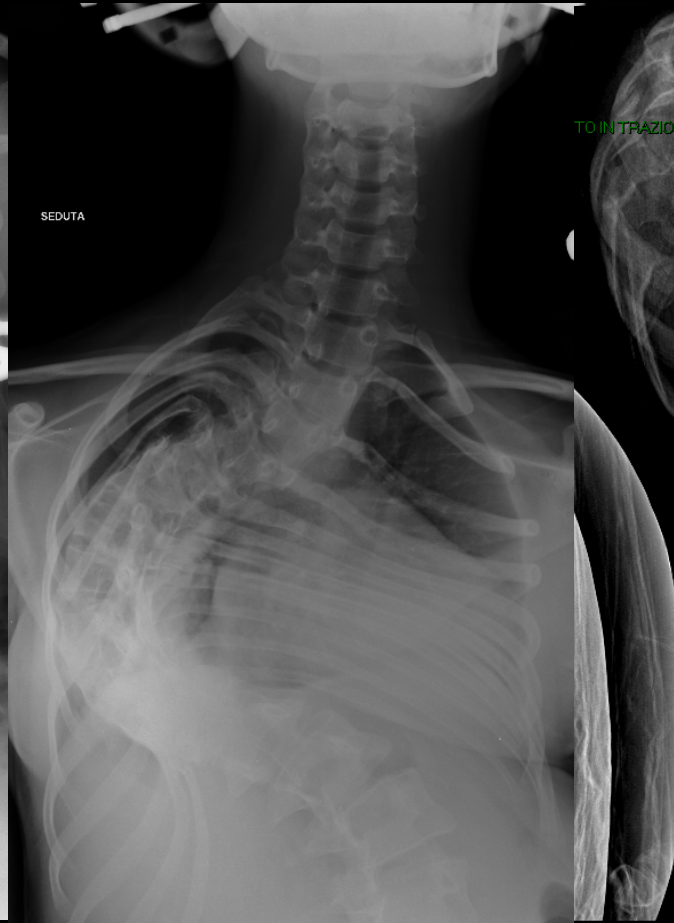
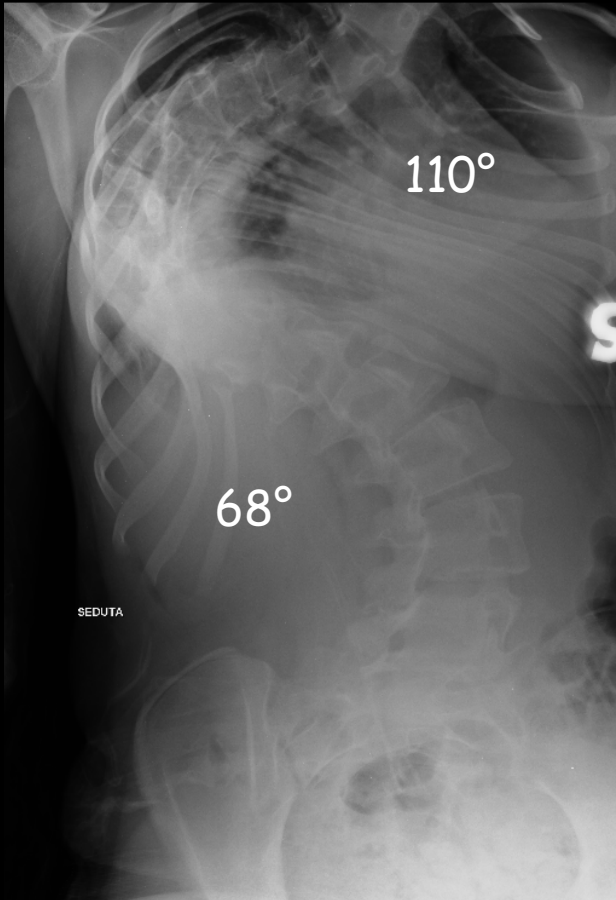
D. F. 13 aa

Risser cast

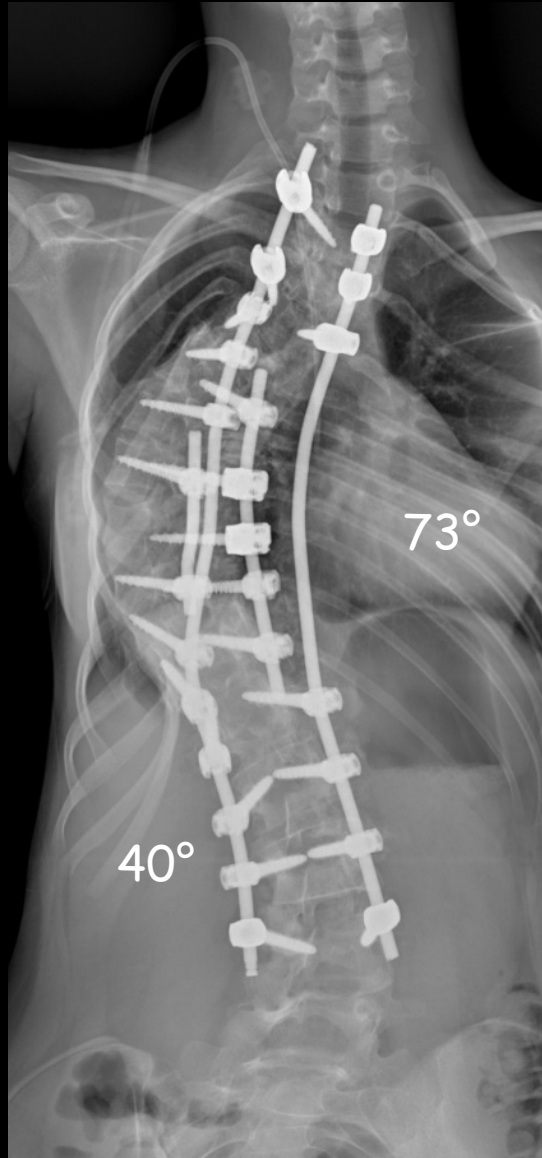
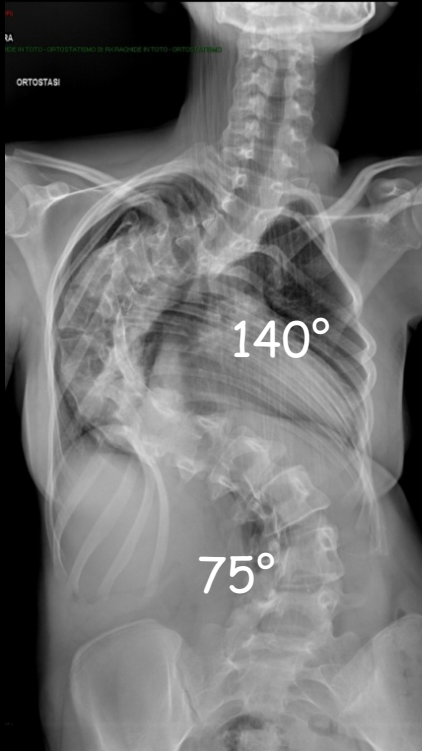


| % MT correction<br>Risser/Bending | % L correction<br>Risser/Bending |
|-----------------------------------|----------------------------------|
| 25%                               | 11%                              |

# D. F. Dopo 22 gg di halo



D. F.





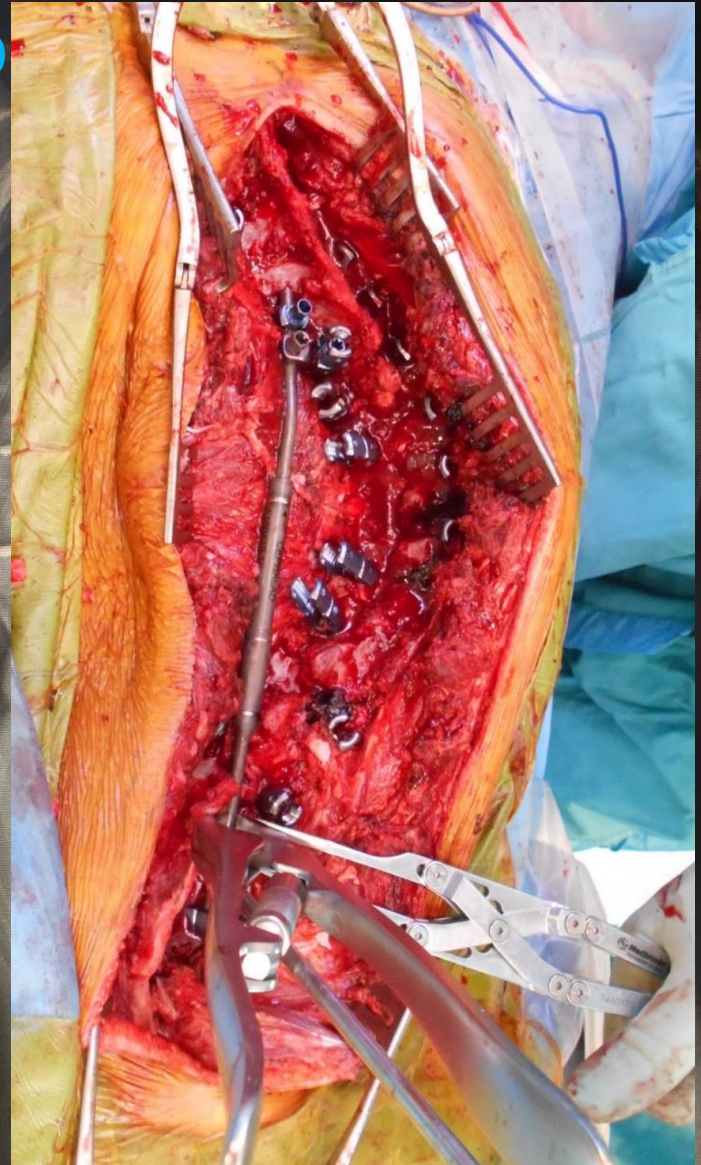
20 gg di halo  
trazione



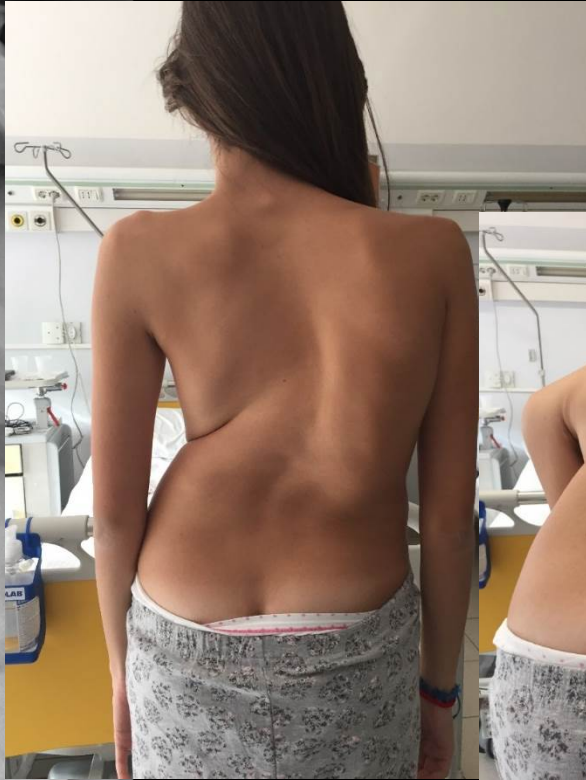
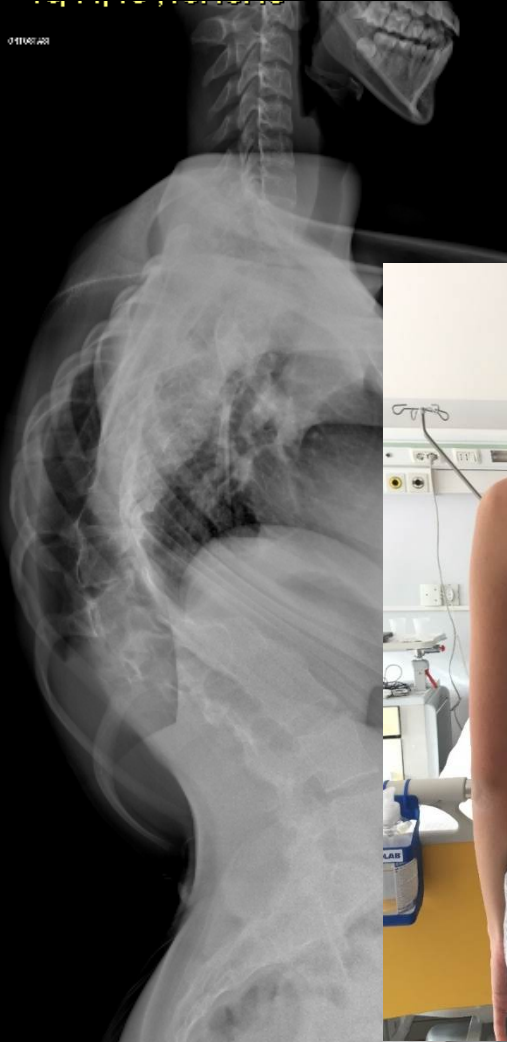
# Scoliosi Severe

Alternativa alla Trazione Halo

Trattamento Posteriore  
in 2 tempi  
con barra magnetica  
allungabile provvisoria  
MAGEC



# Trattamento Posteriore in 2 tempi



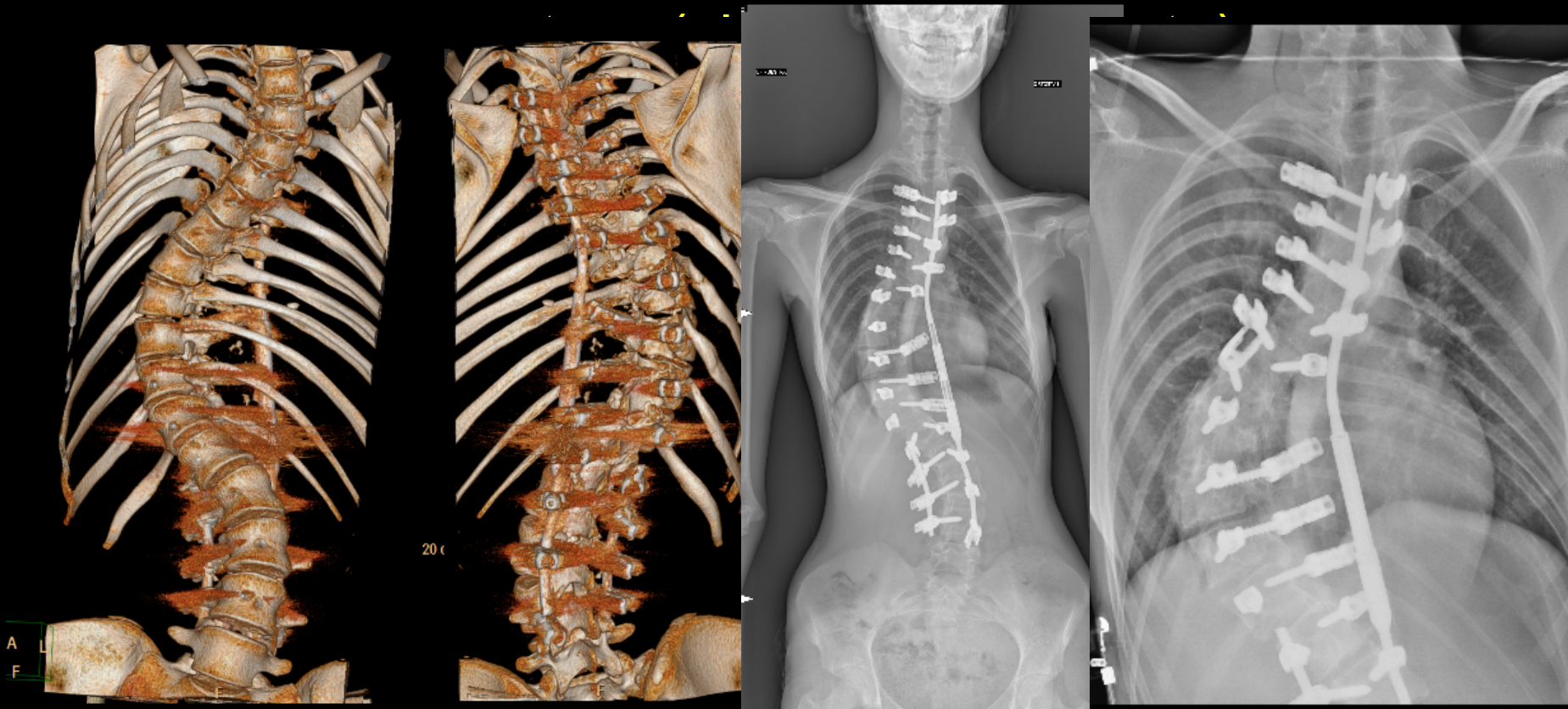
# Trattamento Posteriore in 2 tempi

## 1° intervento

Viti peduncolari  
Osteotomie di Po  
Barra magnetica



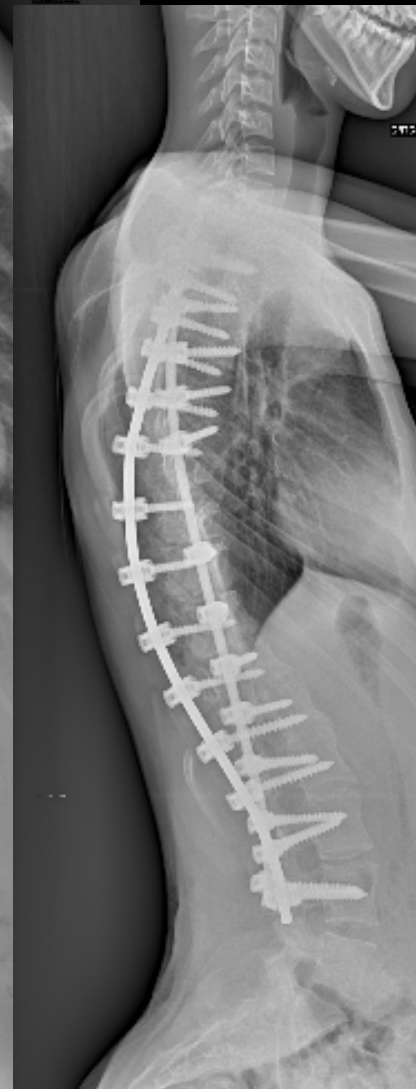
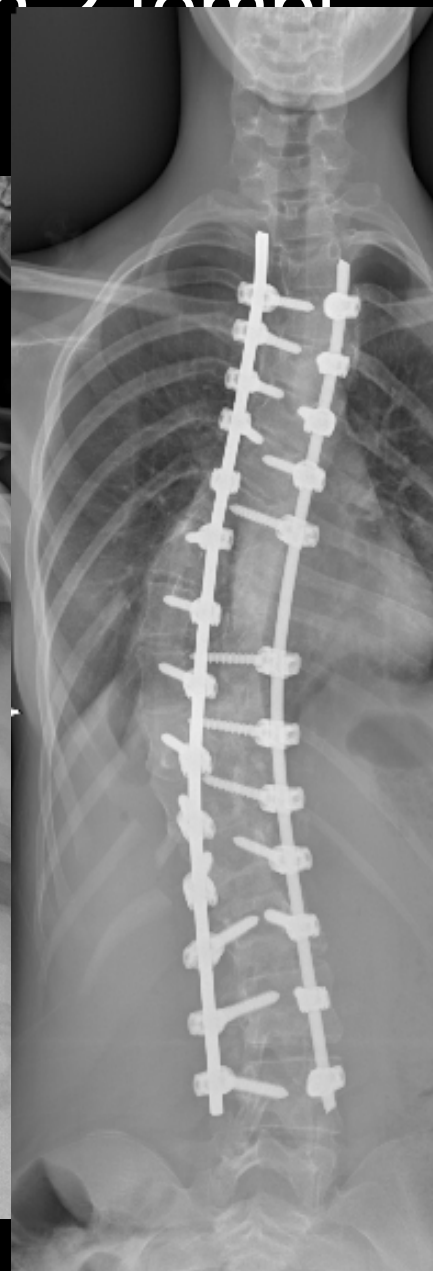
# Trattamento Posteriore in 2 tempi dopo 1° intervento





# Trattamento Posteriore in 2 tempi

## 2° intervento





NOGRAFIA



Osp.

GE MEDICAL S

LE SENZA MDC



Osp. Santa Cor

04/

GE MED

Osp. Santa Corona

S

LE SENZA MDC

ng No cut

Do

E





## Discussione

- Fase breve di allungamento della barra
- Non oltre i 15-18 giorni
- Limiti correttivi oltre questo periodo
- Il secondo tempo chirurgico più breve perchè ancora modesti i fatti riparativi dei piani muscolari



## Discussione

Barra magnetica transitoria per sostituire trazione halo prima della correzione posteriore di una scoliosi severa molto efficace e sicura

Svantaggi: due interventi, costosa.

Vantaggi: dividere la correzione in 2 tempi chirurgici brevi di circa 2 ore, meno aggressiva come impatto chirurgico, ben tollerata