

私の愛した大綱

そしてマイクロサージャリー



名古屋大学 形成外科  
亀井 譲

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円上中学 旭丘高校 名古屋大学医学部
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厚生連加茂病院 研修医  
厚生連加茂病院 外科  
静岡済生会総合病院 外科
- H1 名古屋大学医学部 形成外科  
愛知医科大学 形成外科  
The University of Texas MD Anderson Cancer Center  
岐阜県立多治見病院 形成外科
- H10 名古屋大学医学部 形成外科

# 名古屋大学形成外科

癌切除後の再建

放射線潰瘍の再建

骨髄炎治療

マイクロサージャリーによる再建

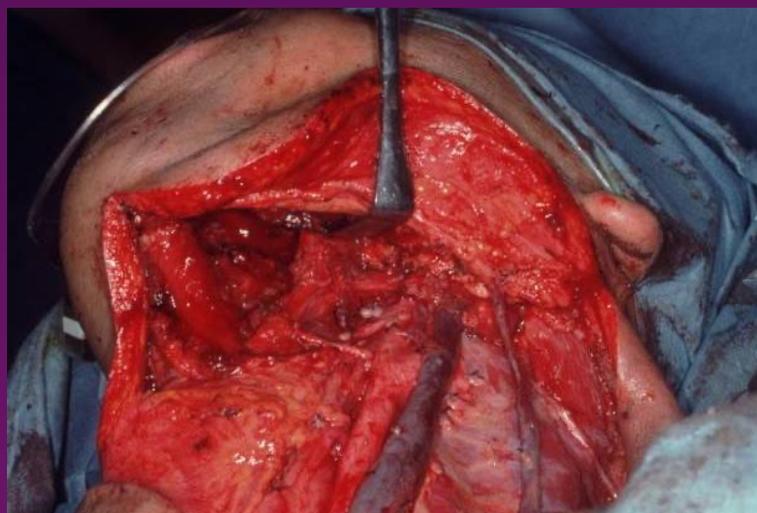
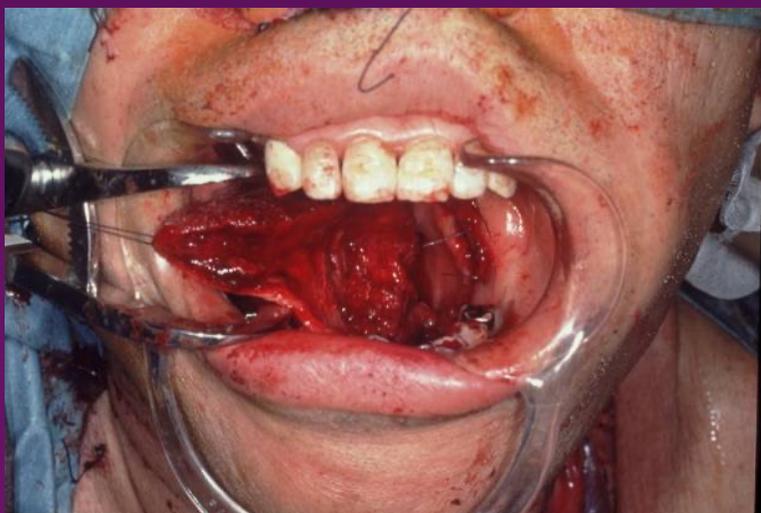
# マイクロサージャリーによる再建

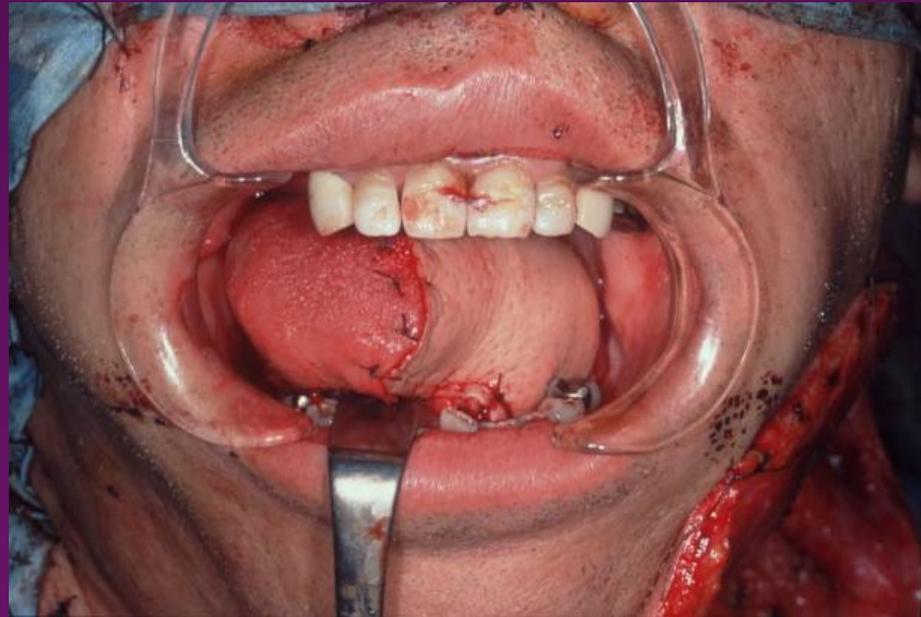
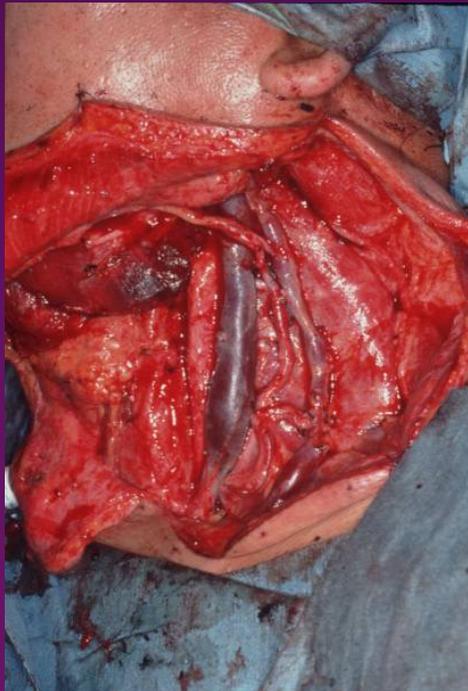
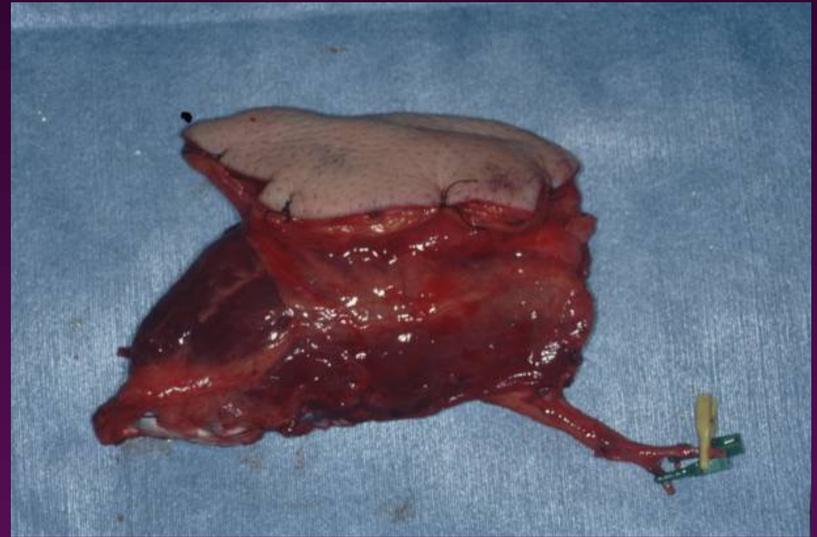
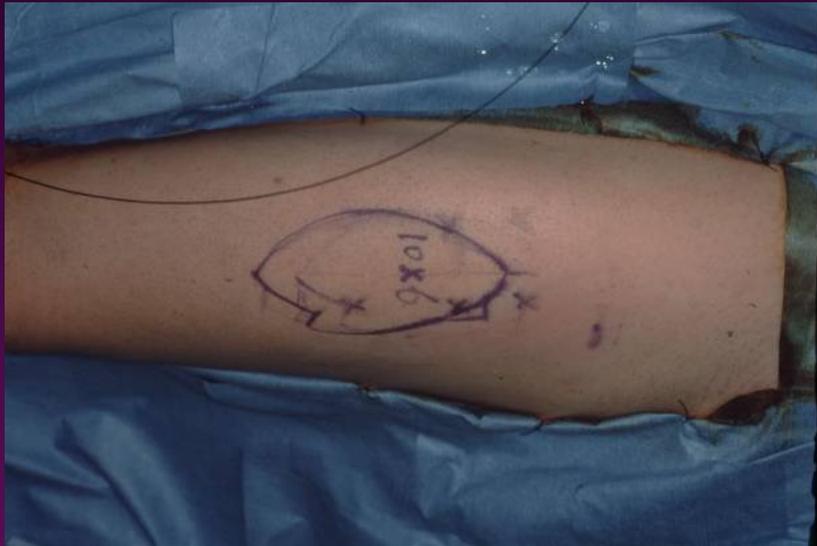
## 遊離組織移植

皮弁移植において栄養血管を一度切り離して欠損部付近の血管と吻合することで遊離となった皮弁を移植すること

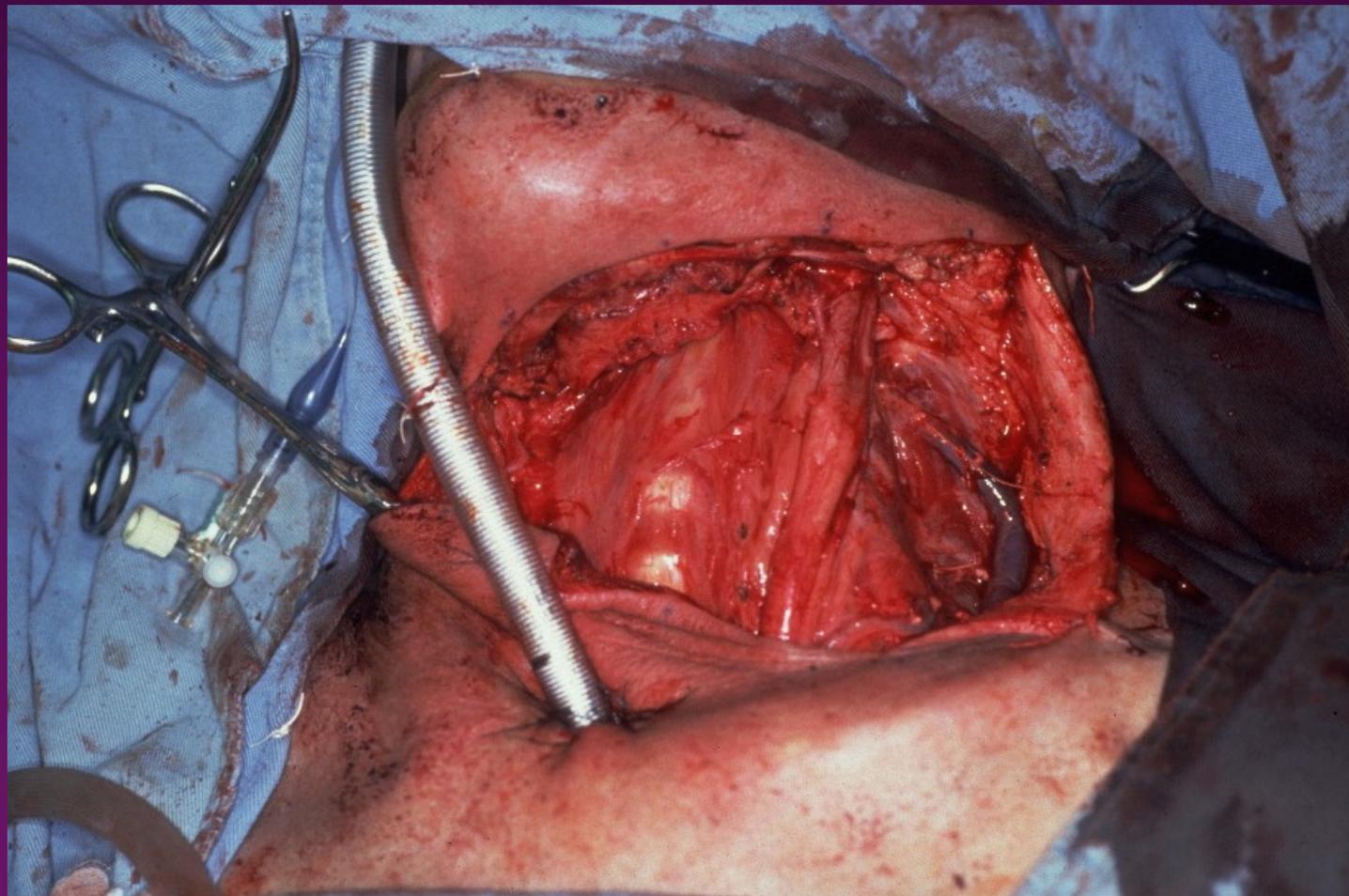
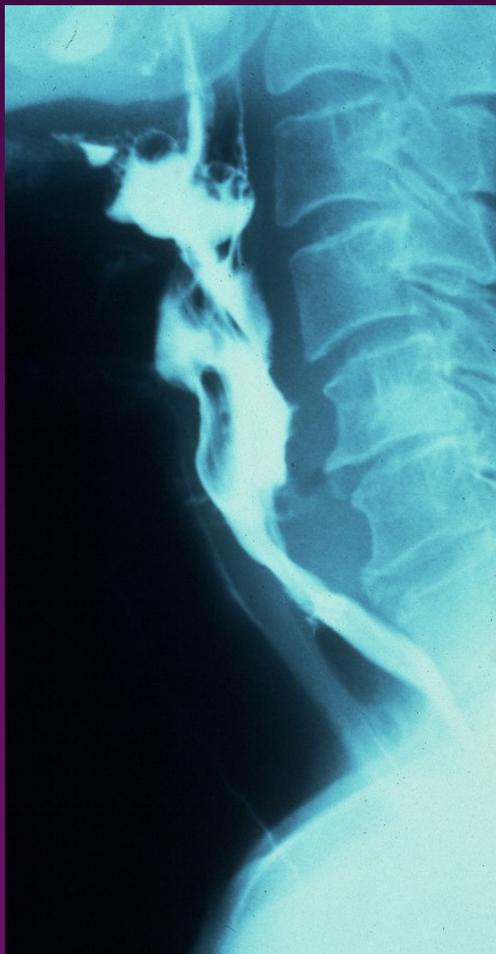
# 再建外科とマイクロサージャリー

## 遊離組織移植

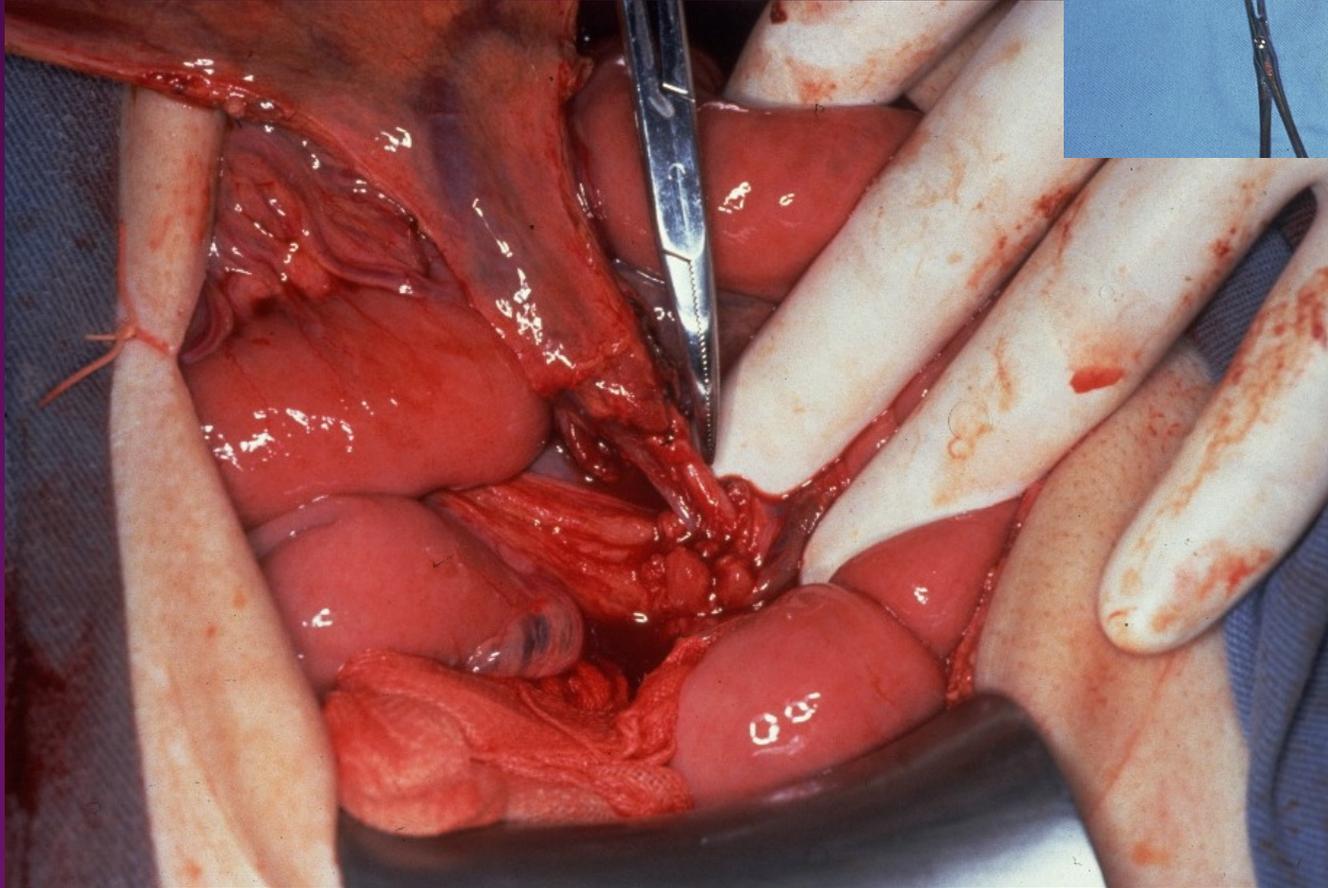
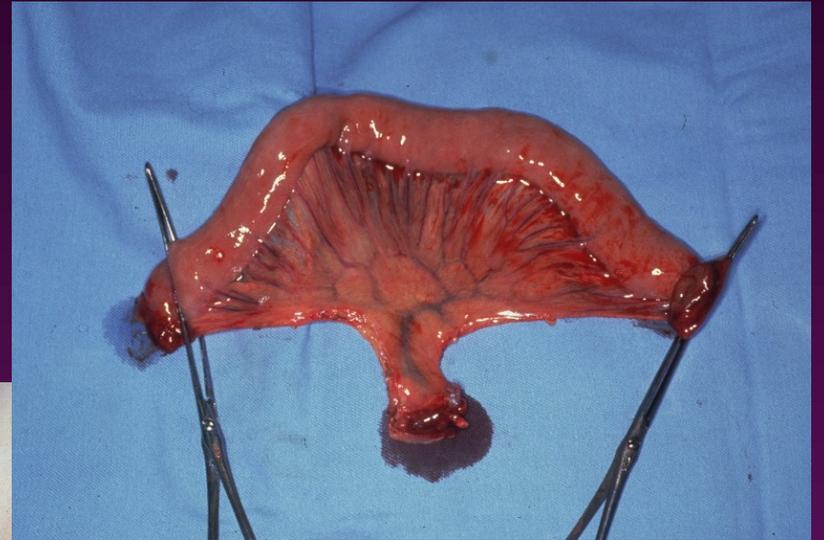


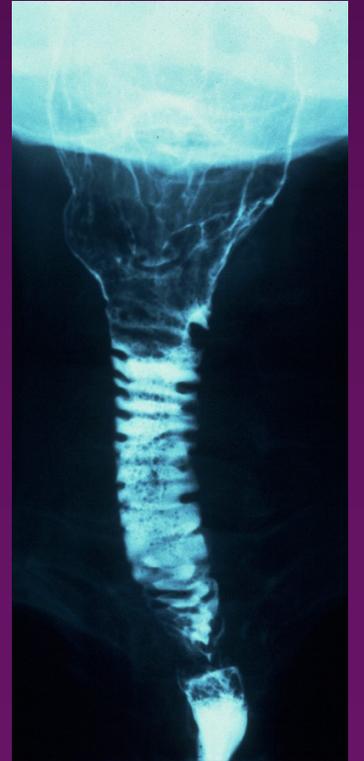
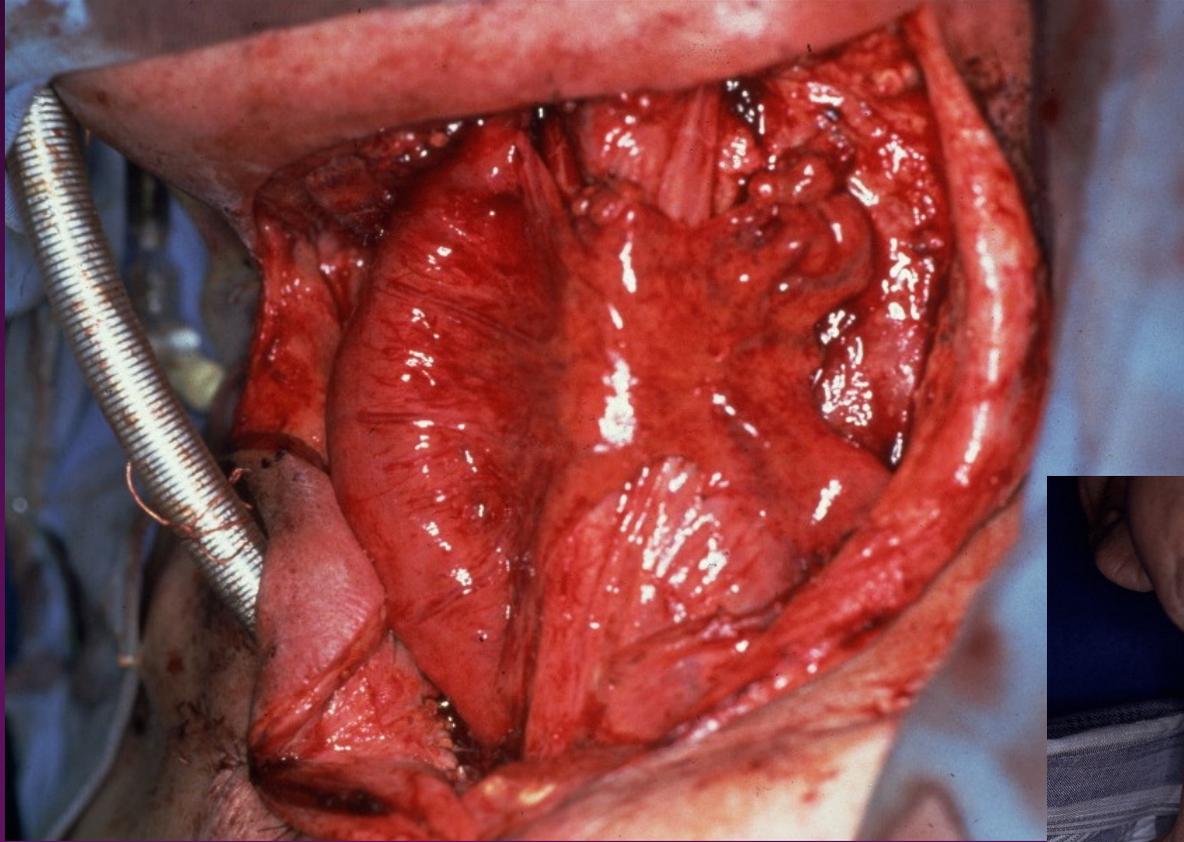


# 下咽頭癌

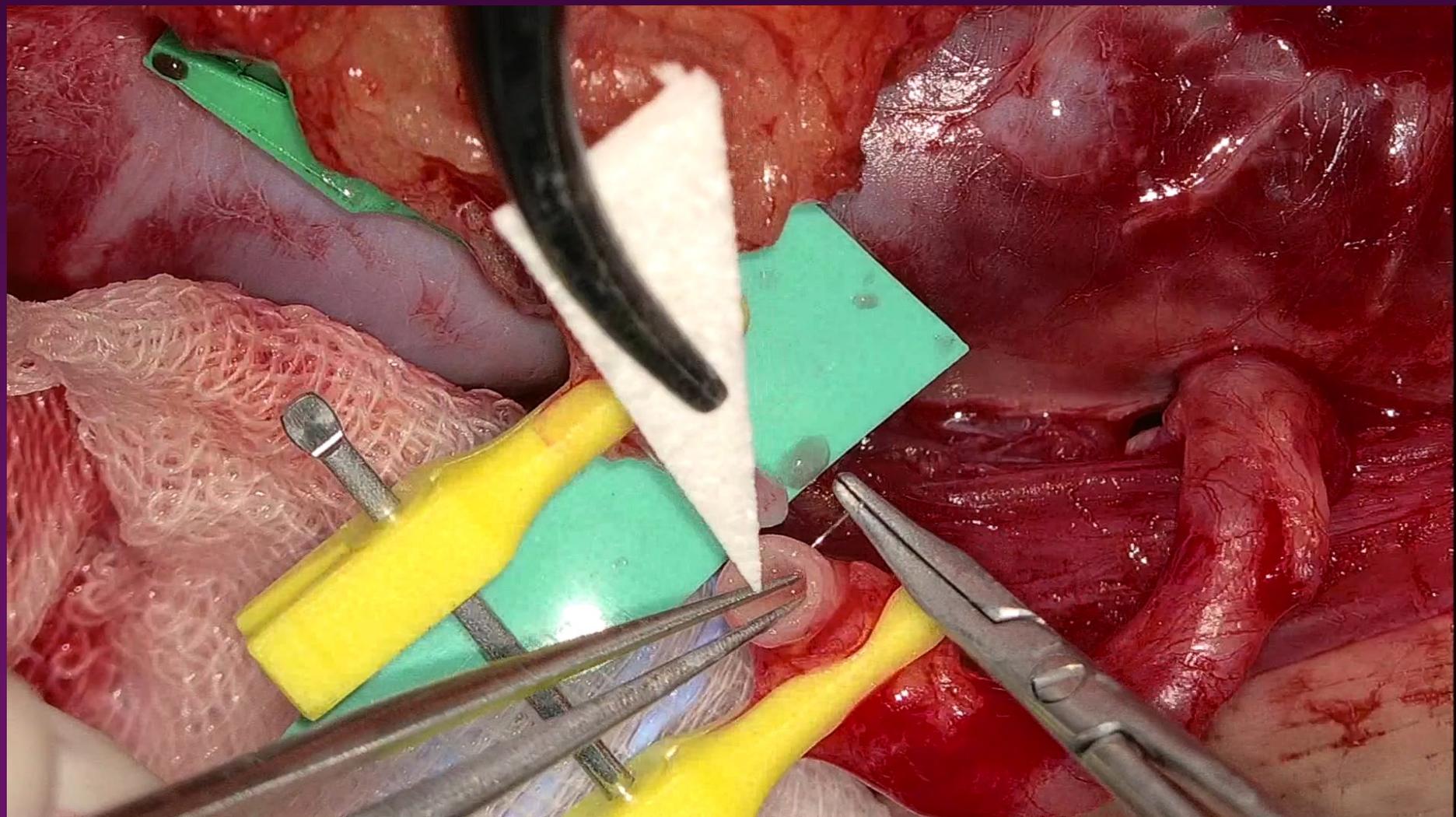


# 遊離空腸

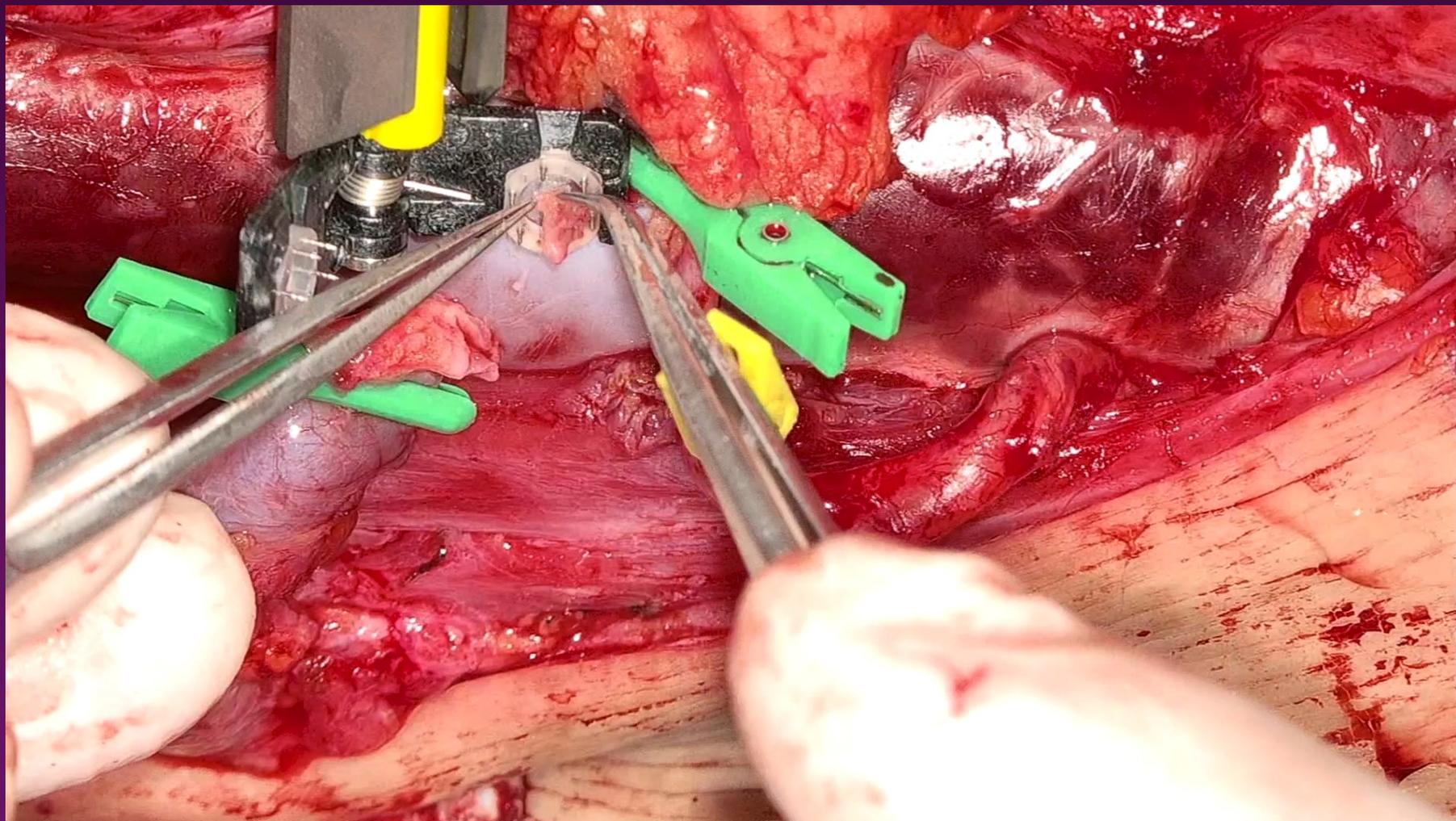




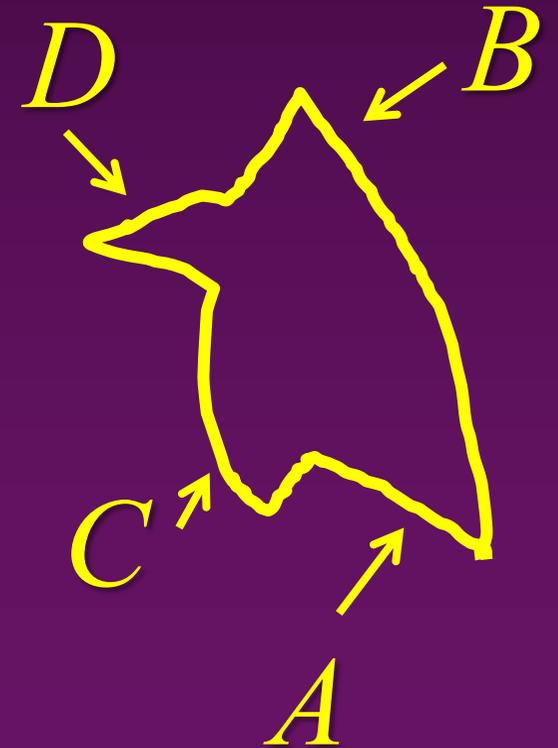
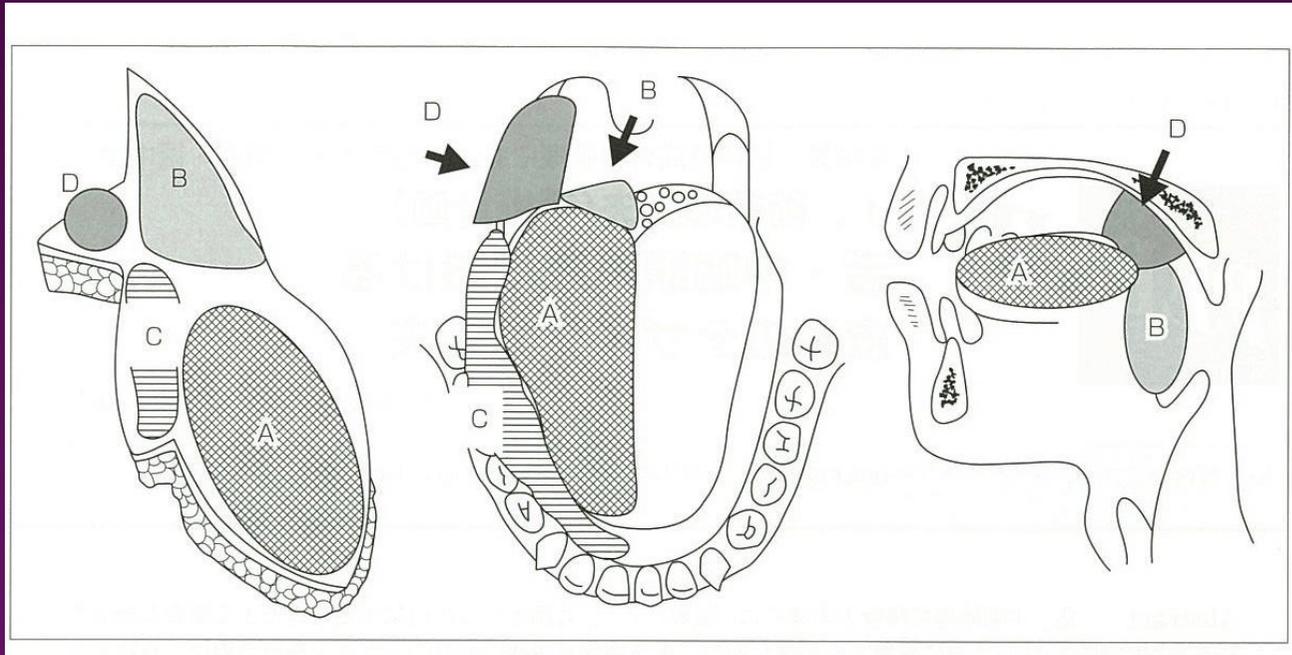
# 動脈吻合



# 靜脈吻合



# 皮弁デザイン



*ALT*

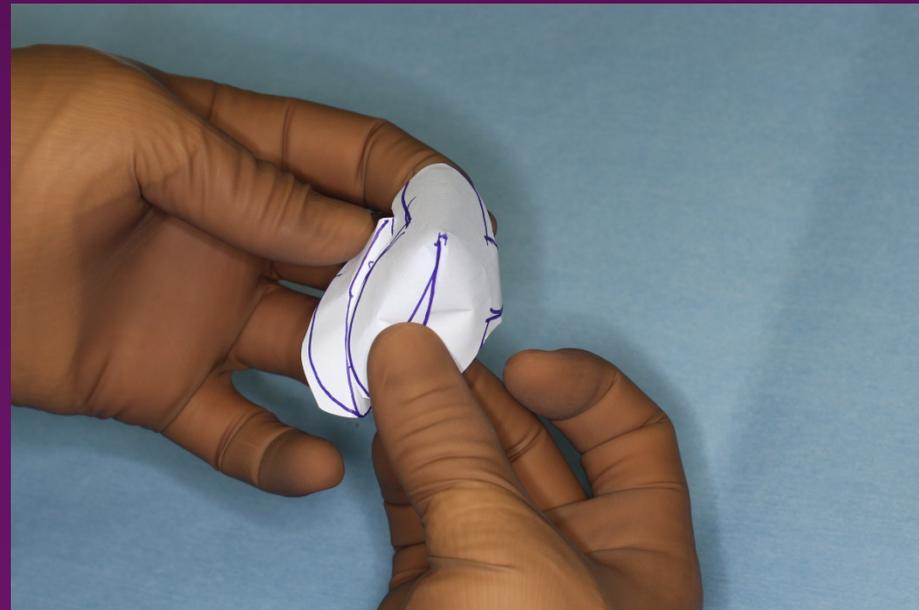


*26 × 15 cm*



*24 × 13 cm*

# 舌亞全摘 遊離腹直筋皮弁



# 名古屋大学および関連病院

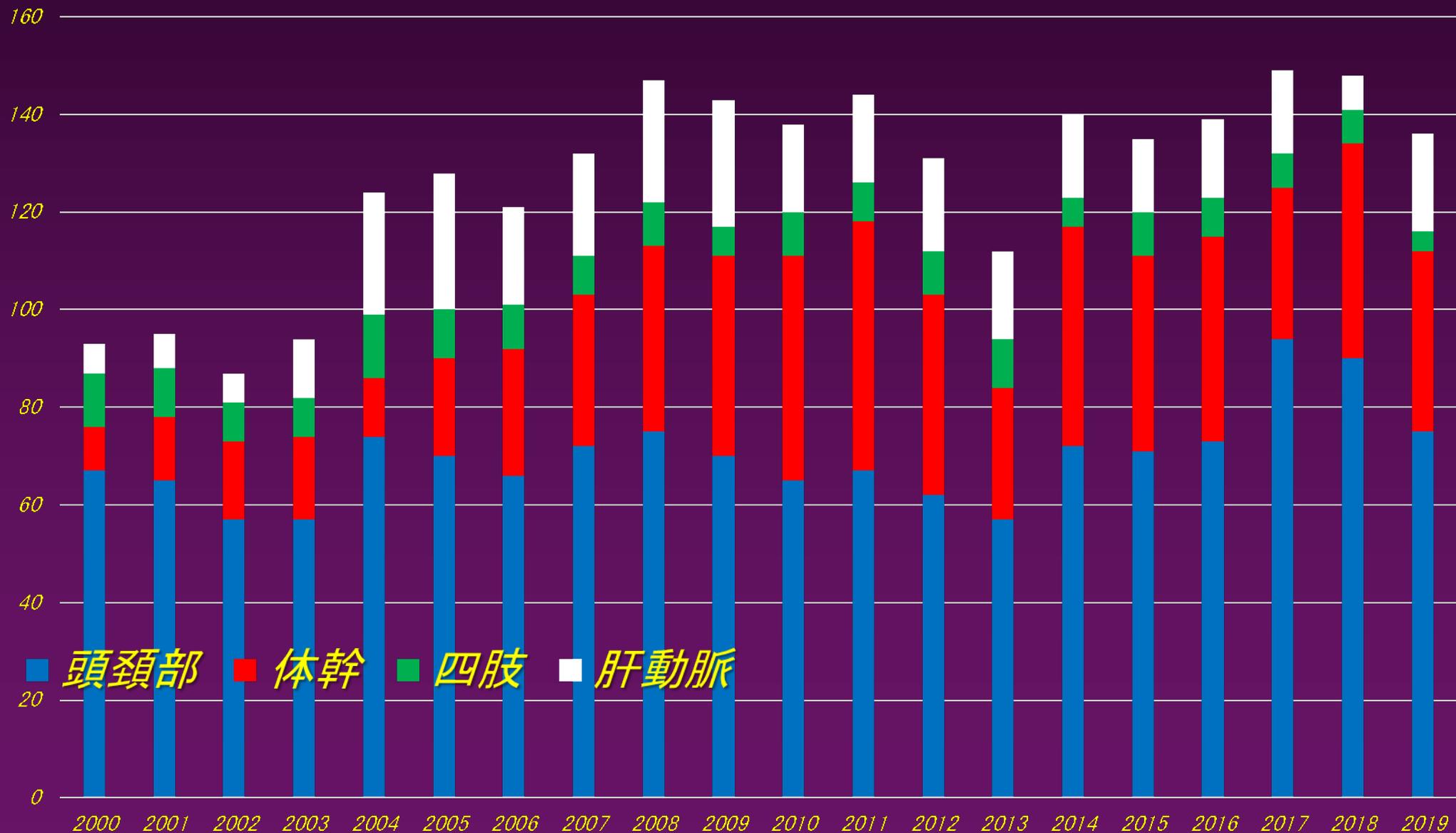
2000年～2019年

2536例

2000年～2004年	493	(99/年)
2005年～2009年	671	(134/年)
2010年～2014年	665	(133/年)
2015年～2019年	707	(141/年)

# 名古屋大学 2000年~2019年

2536例



# マイクロサージャリー手術 2536例

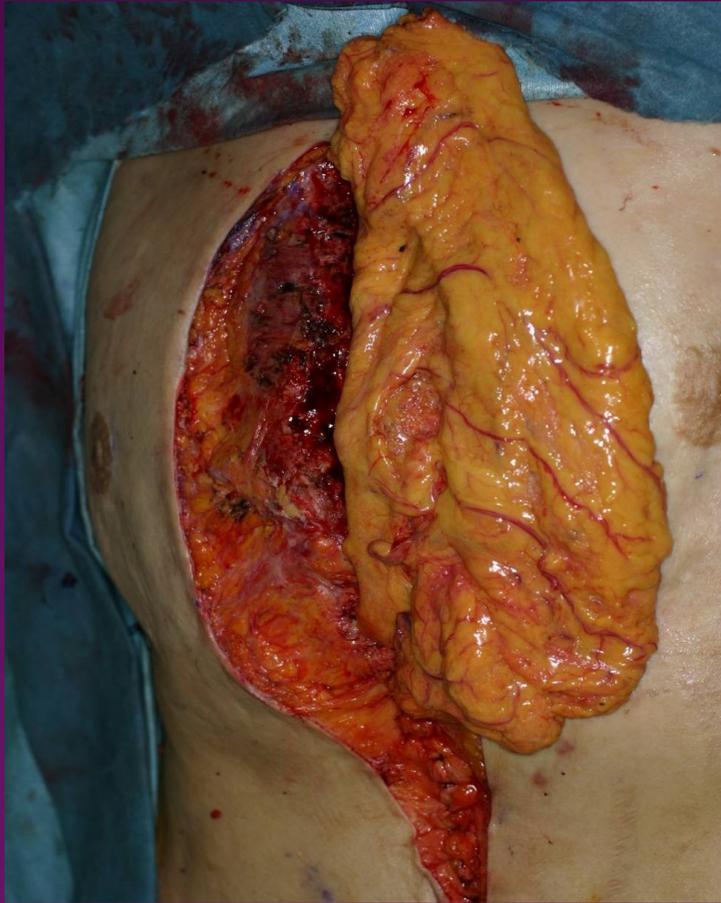
( 2000年 ~ 2019年 )

## 血管吻合 trouble

2000年~2004年	12/493 (2.4%)
2005年~2009年	9/671 (1.3%)
2010年~2014年	6/665 (0.9%)
2015年~2019年	6/707 (0.8%)

# 大網との出会い

## 胸骨骨髓炎



大網 = *Omentum*



*Omen* =

得体の知れぬもの



# 大網の特徴 1

胎生期には造血作用

乳斑 (milky spot) の存在



→ 豊富なリンパ球

豊富な増殖因子

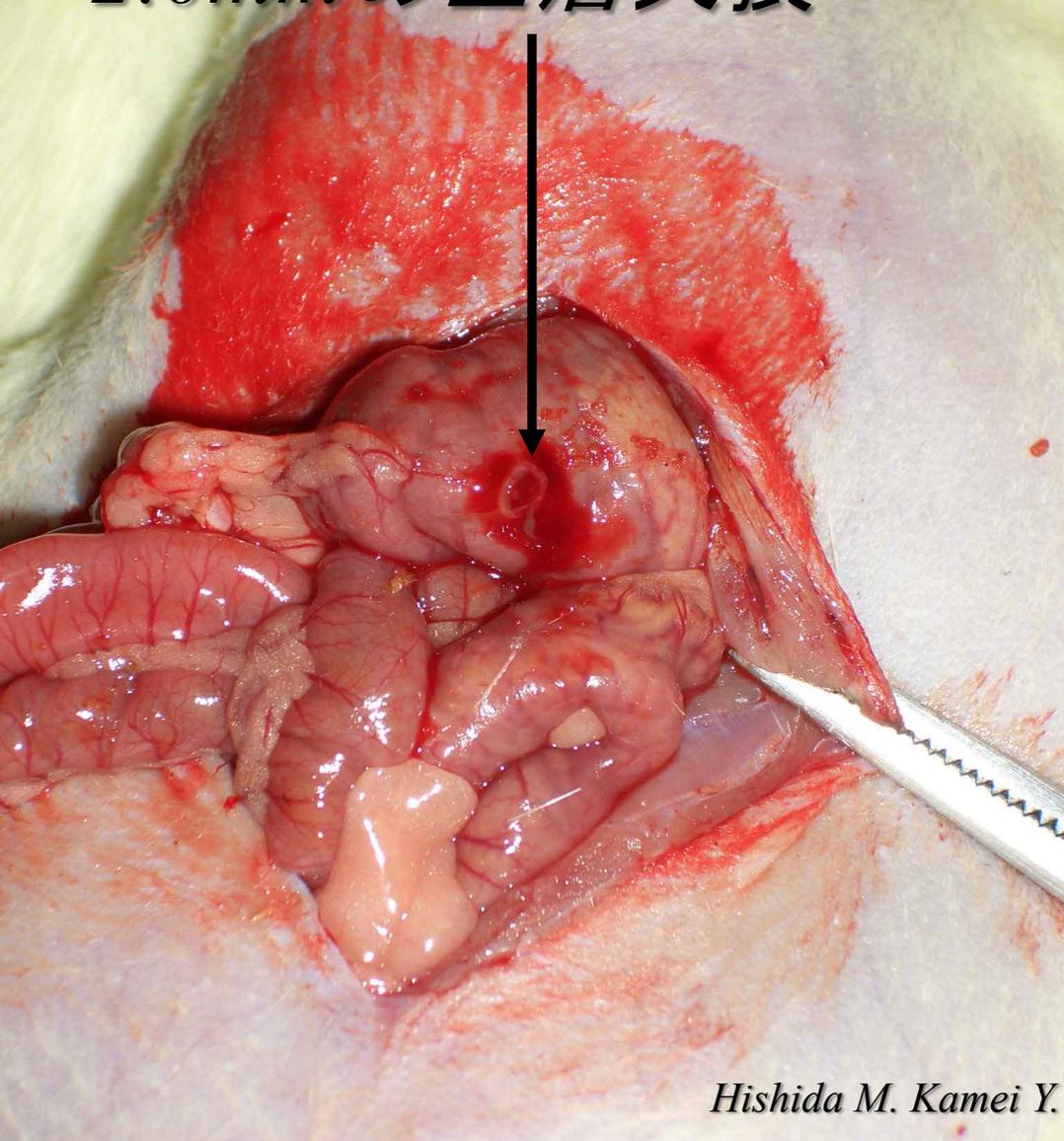
形成外科 → 傷を治すプロ

大網の創傷治癒への影響は？

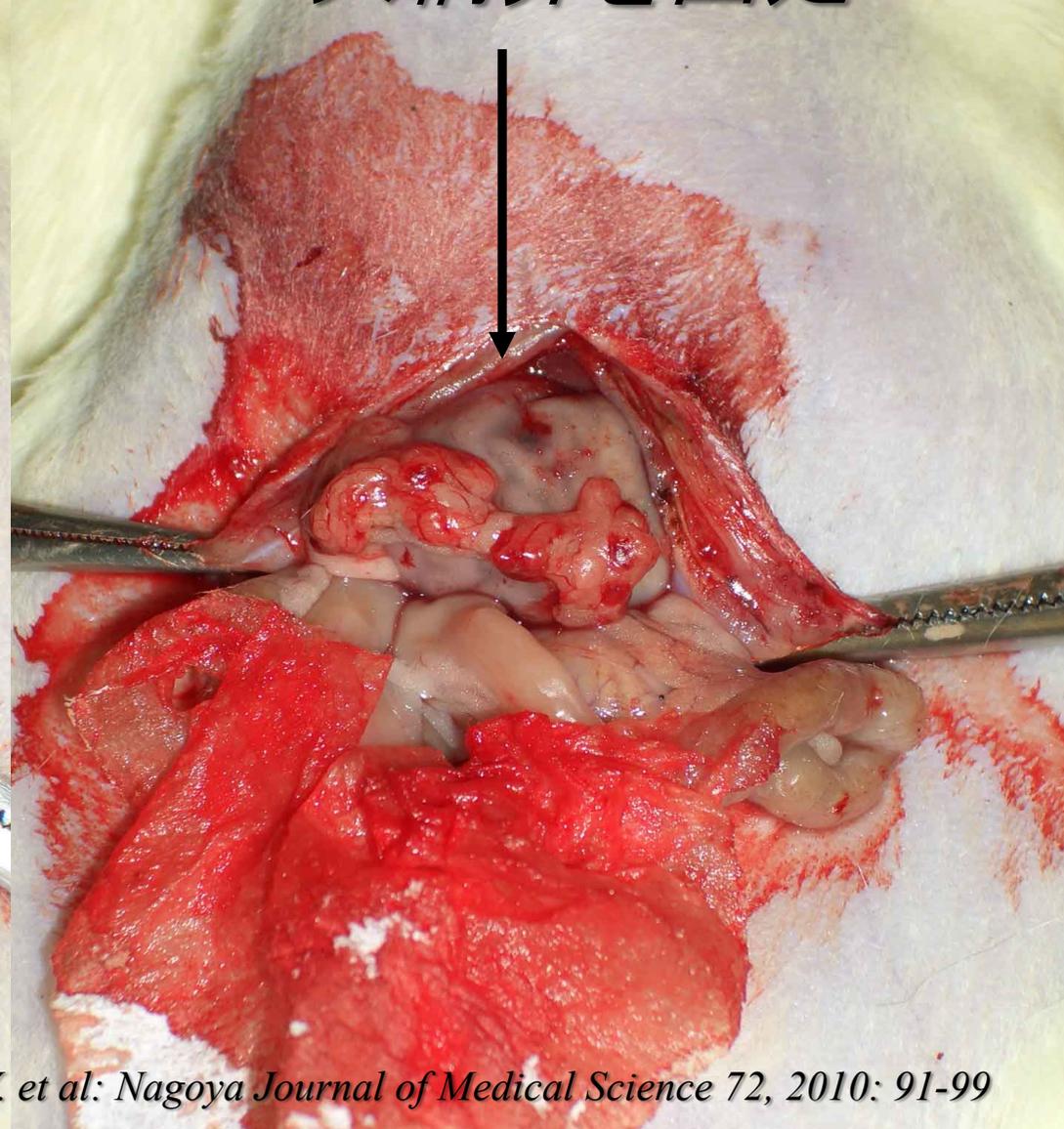
早く治癒するのか？

どのような形態で治癒するのか？

2.0mmの全層欠損



大網弁を固定



1日目

3日目

4日目

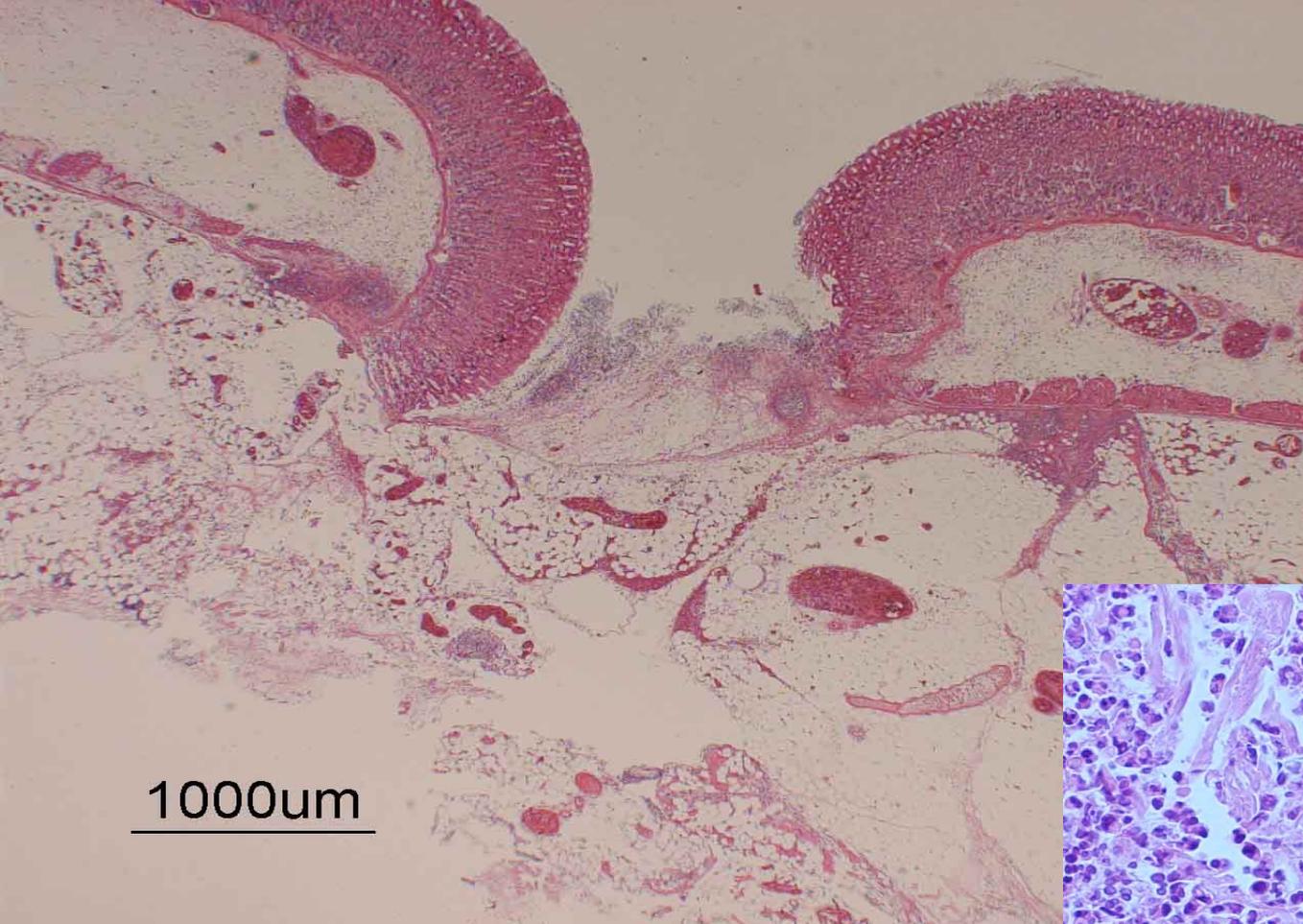
6日目

7日目



10日目

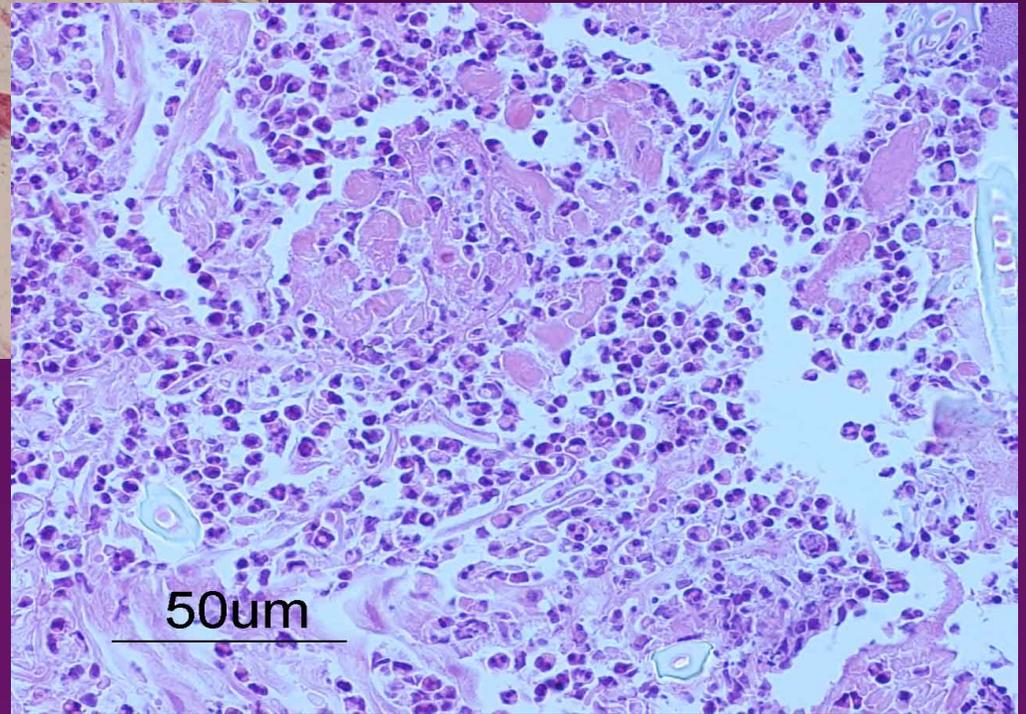




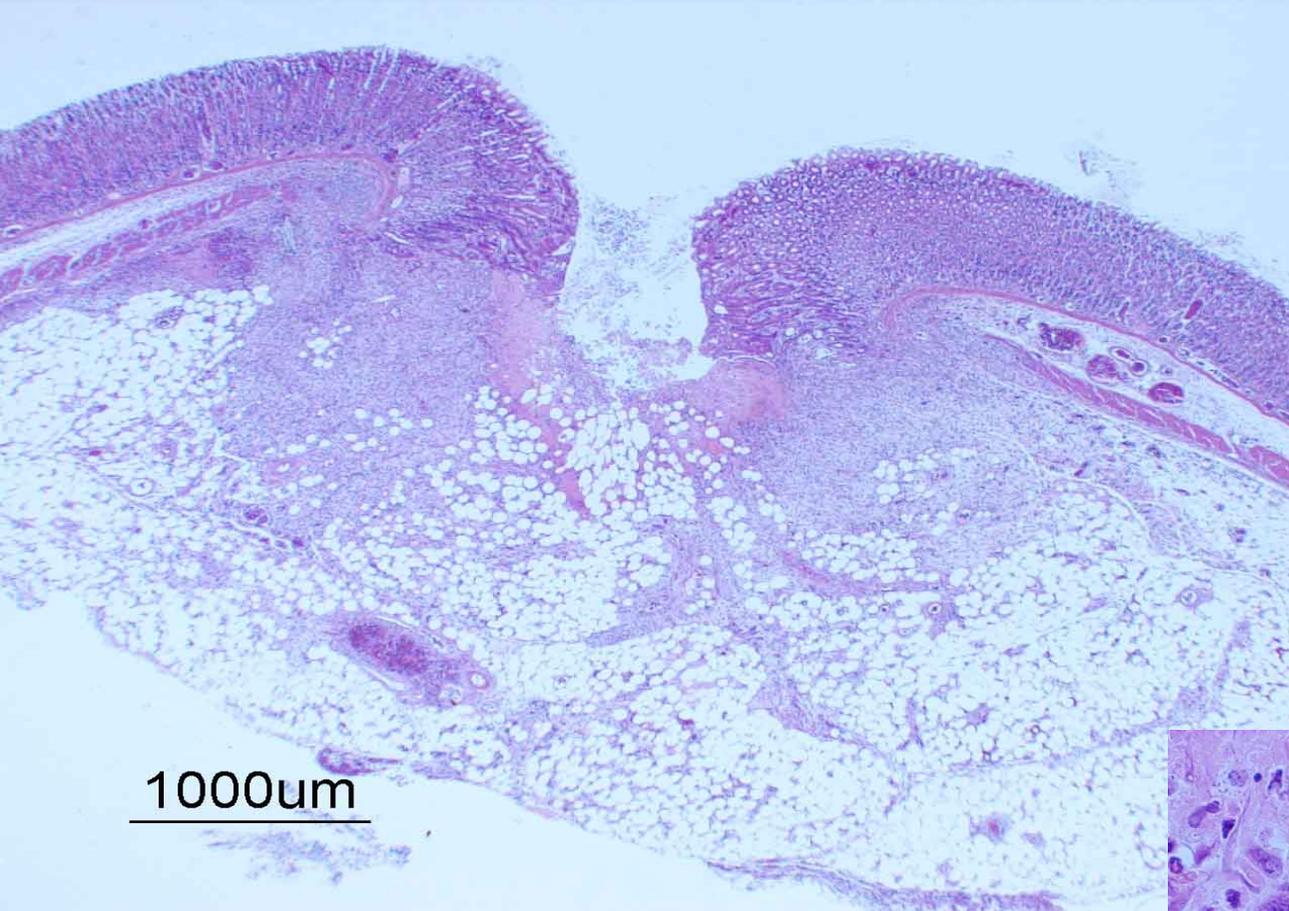
1日目

1000um

潰瘍底 1.48 mm



50um



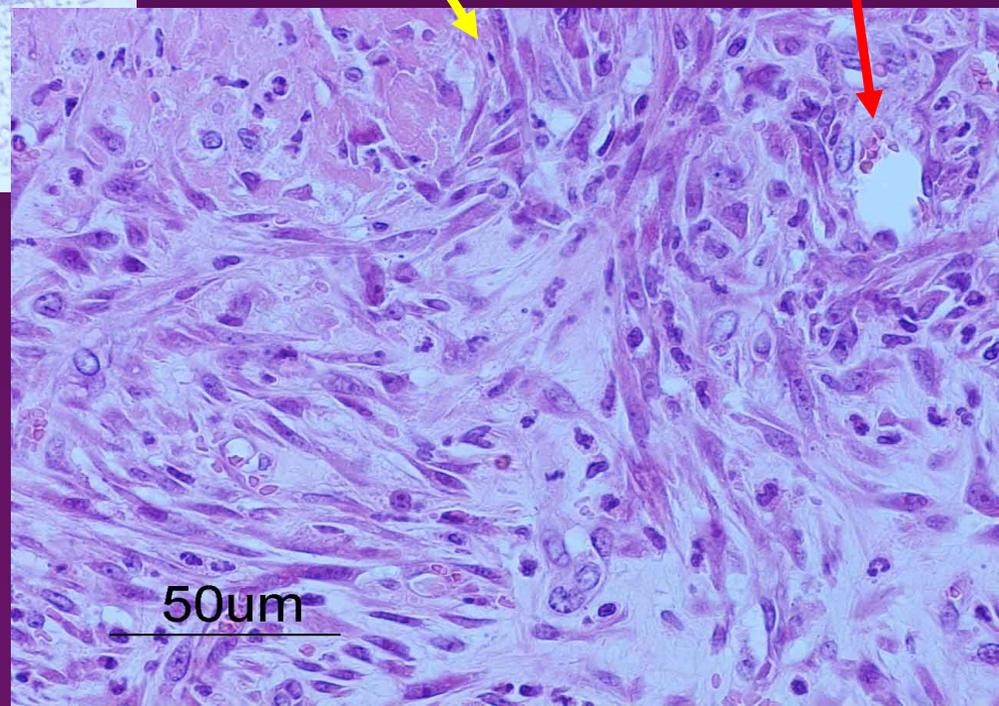
4日目

線維芽細胞

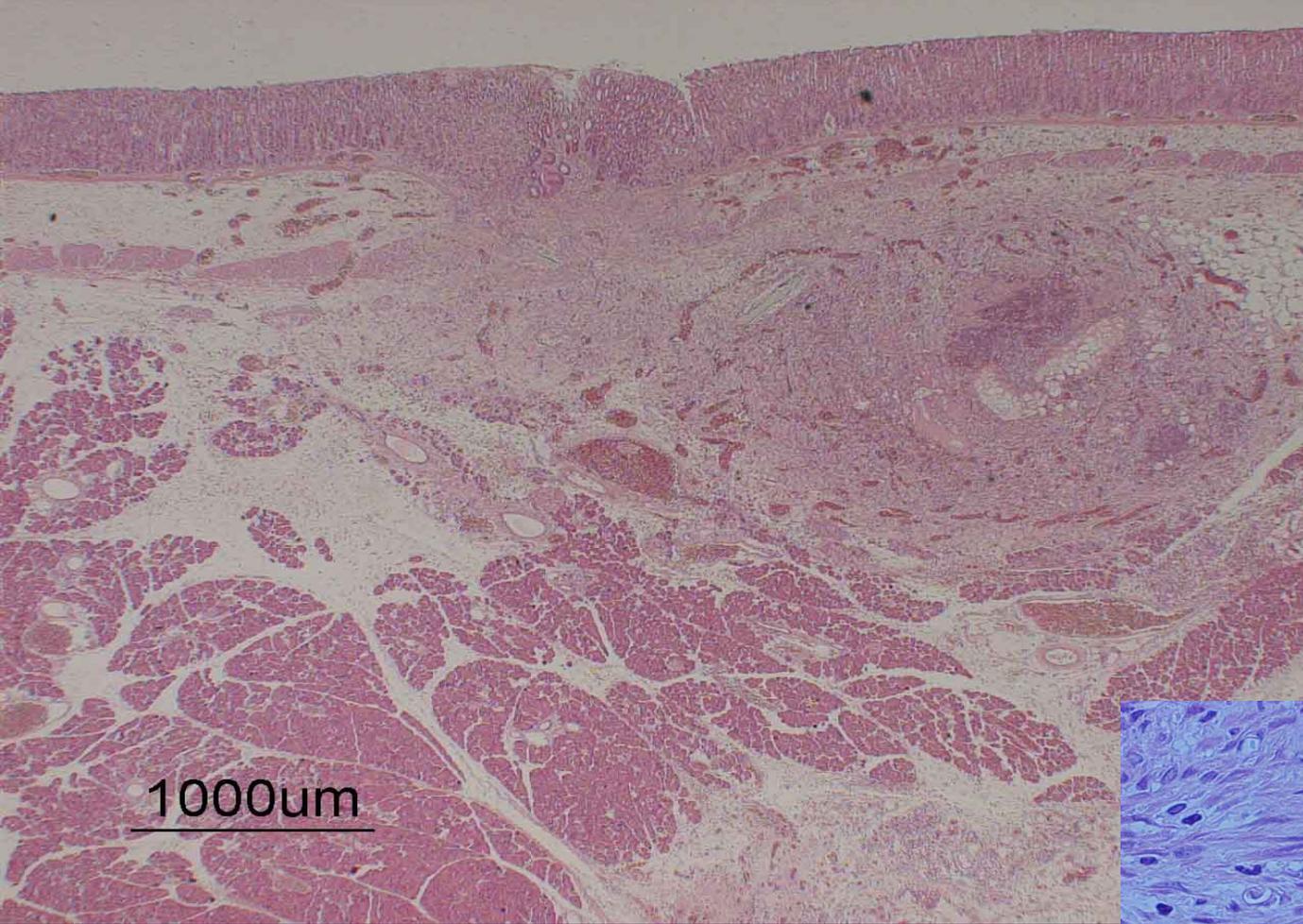
新生血管

1000um

潰瘍底 0.50 mm



50um

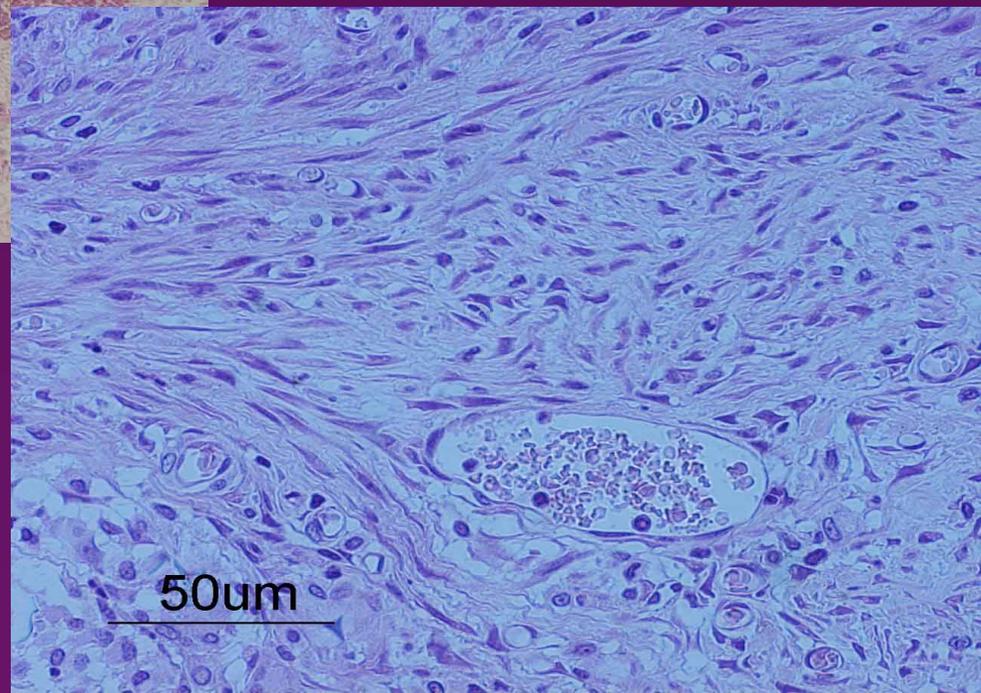


1000um

## 7日目

腺構造の重層化  
粘膜下層の連続性

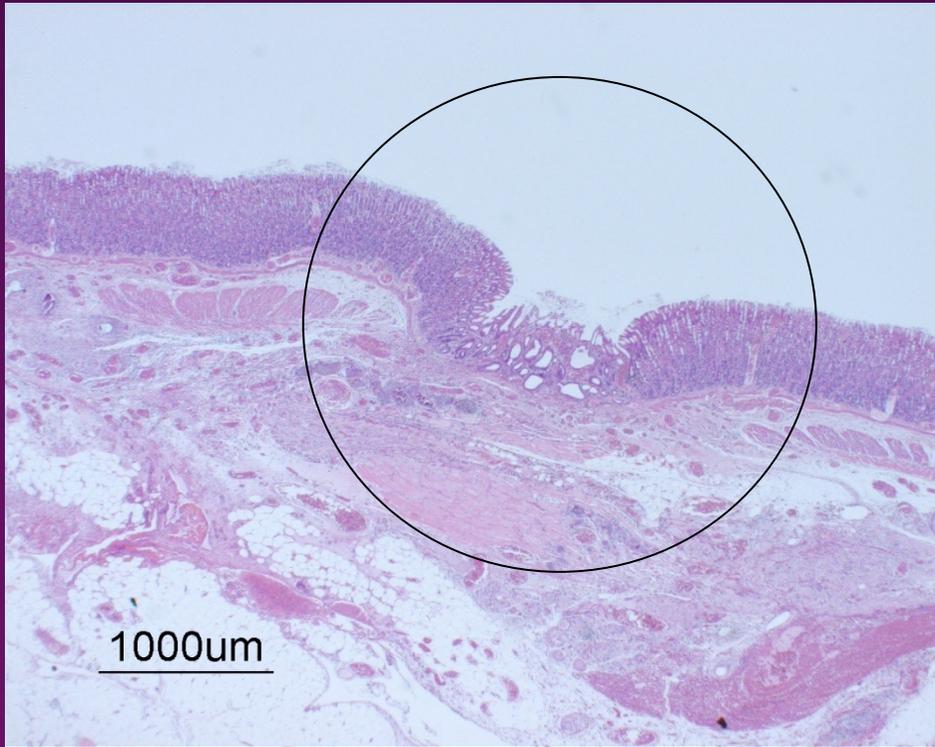
潰瘍底なくなる



50um

21日目

筋弁



7日目

大網



# 結論

1～3日目までを炎症期

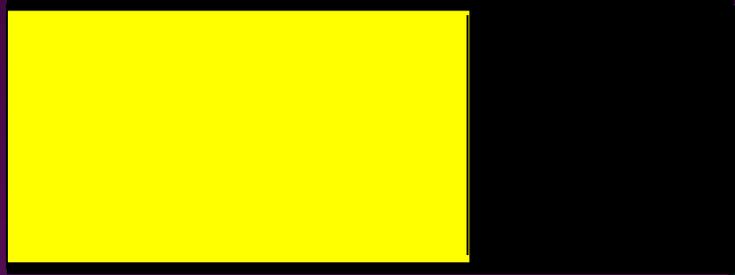
4～5日目までを血管新生期

5～6日目までを肉芽形成期

6日目以降を上皮化

上皮化した下層が良い状態

ラット (300 ~ 350g) 背部に2 × 7cmの皮弁



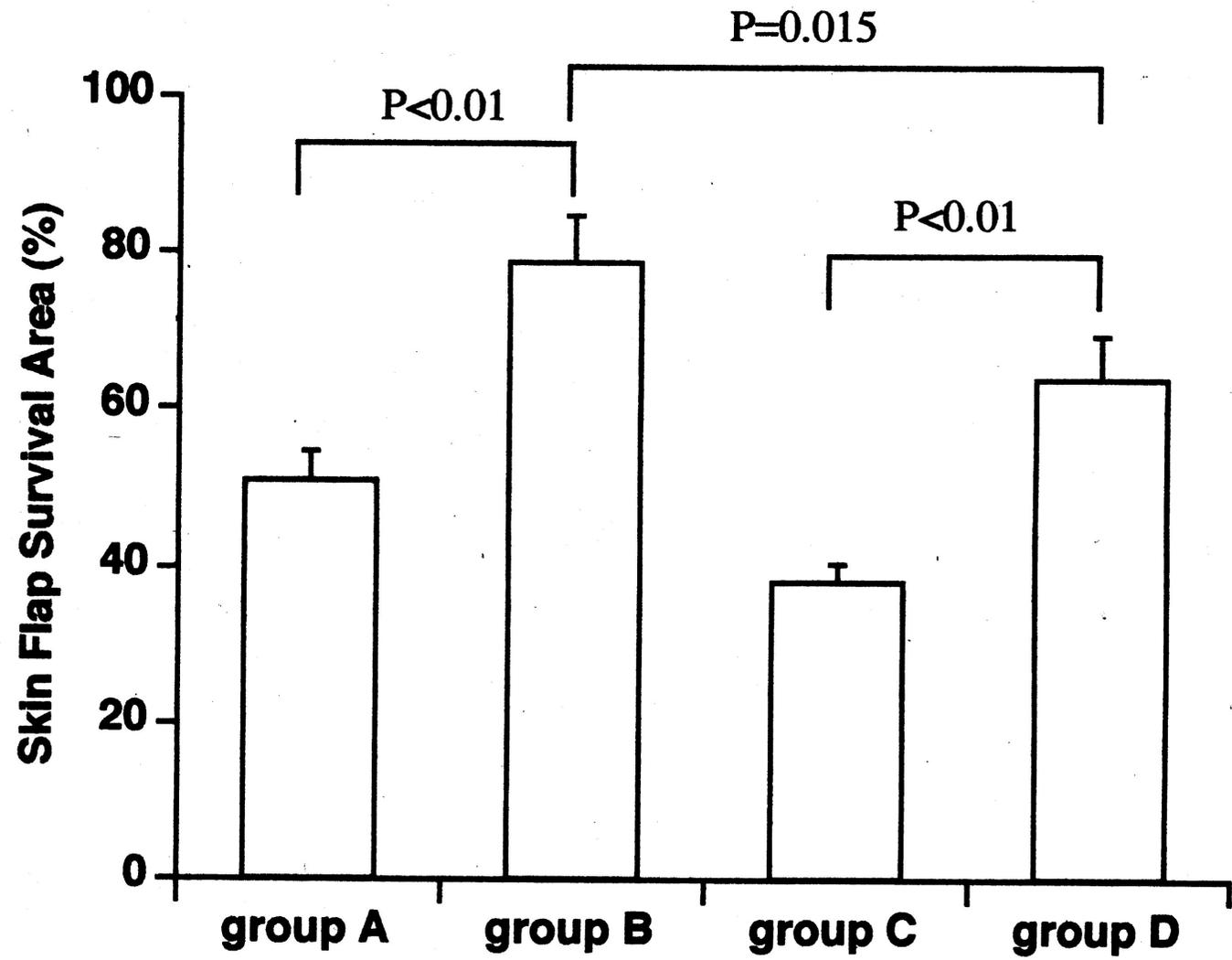
人大網より lipid fractionを抽出

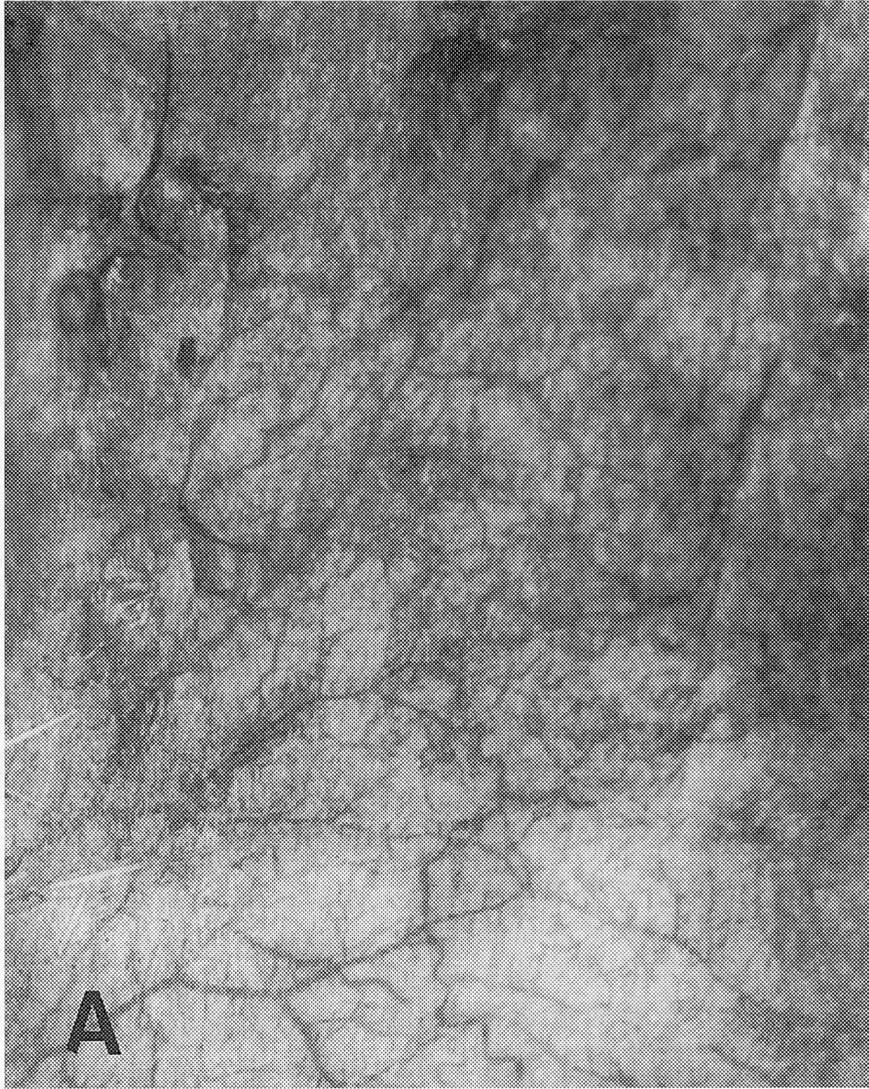
A: 生食 + fibrin glue

B: omental lipid fraction + fibrin glue

C: 生食 + fibrin glue + silicone sheet

D: omental lipid fraction + fibrin glue + silicone sheet





*Omentum*

*PGE1*

*FGF* など

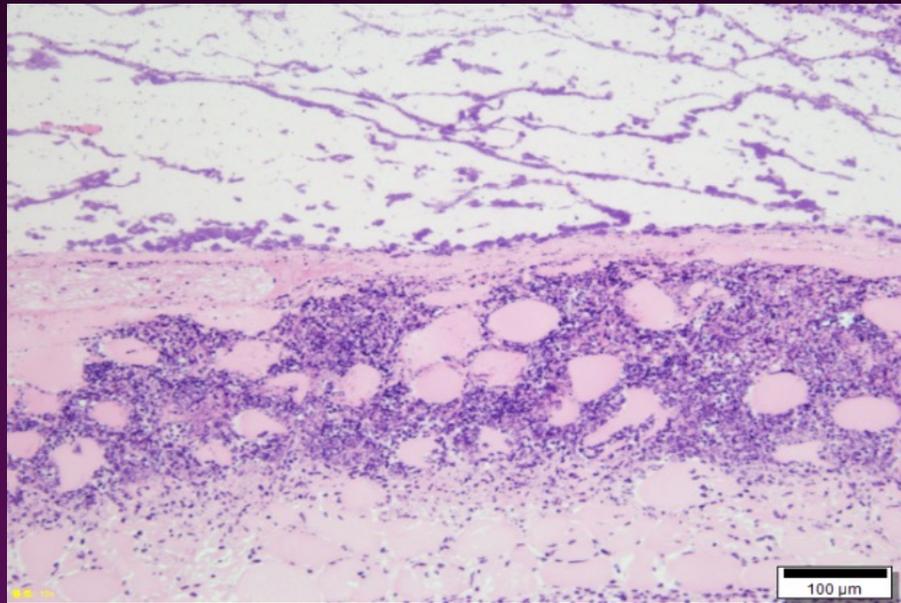
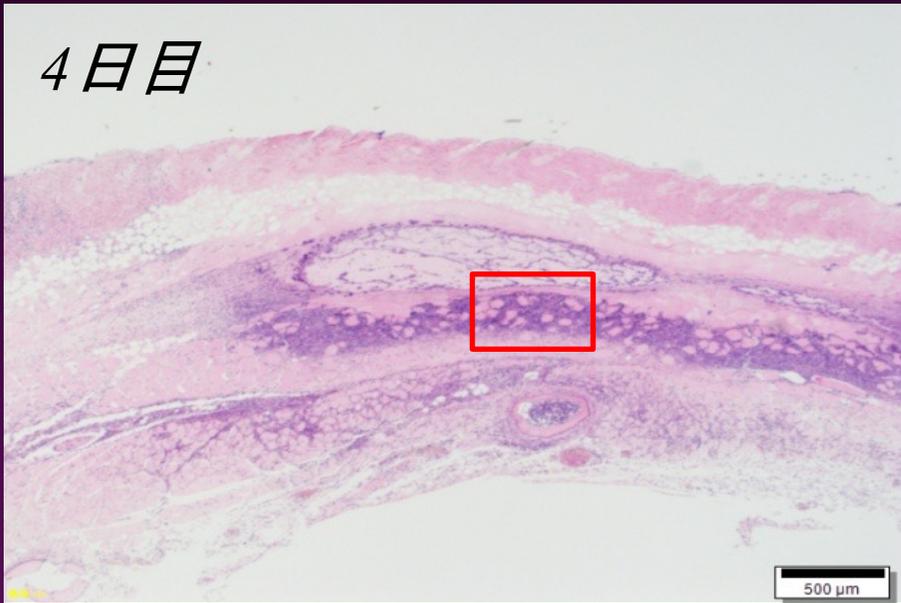
*Angiogenesis* の存在

大網は感染に強いのか？

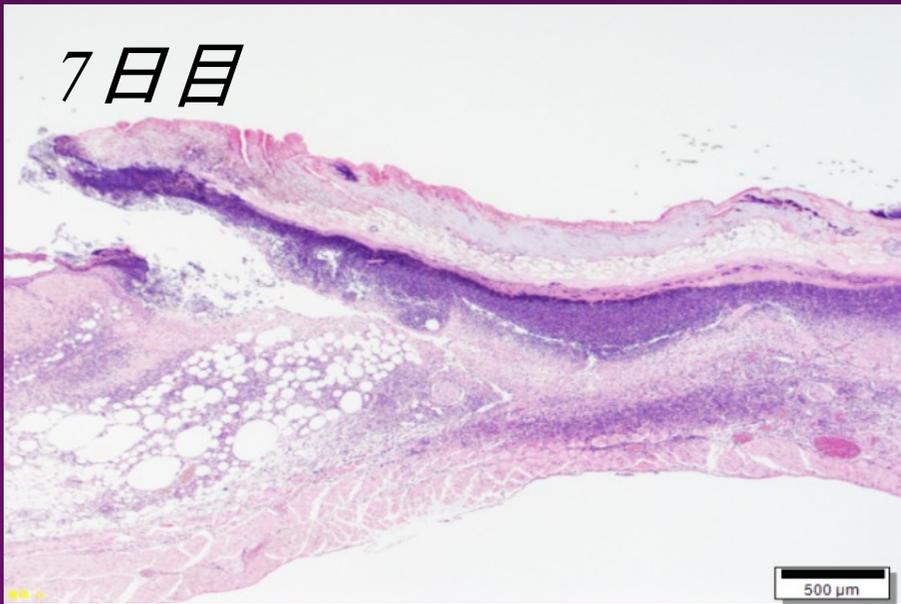
- ・液体培地 (Luria Broth (Sigma, USA)) + 粉末寒天 (Wako, Osaka) → 半流動培地 (最終寒天濃度:0.05%)
- ・寒天の濃度は25G の注射針を楽に通過して、その形態を維持できる濃度
- ・半流動培地に黄色ブドウ球菌を混入して200 $\mu$ l マウス皮下



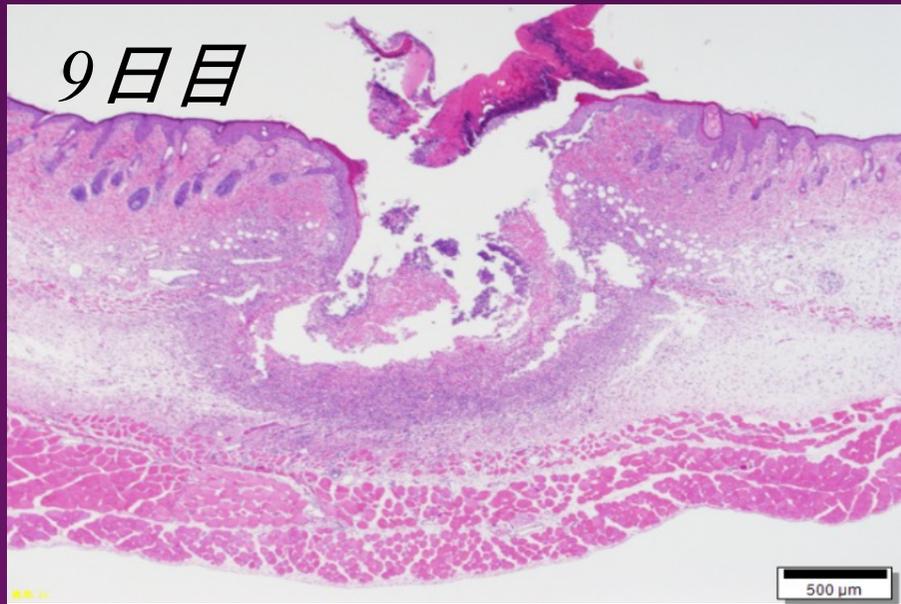
4日目



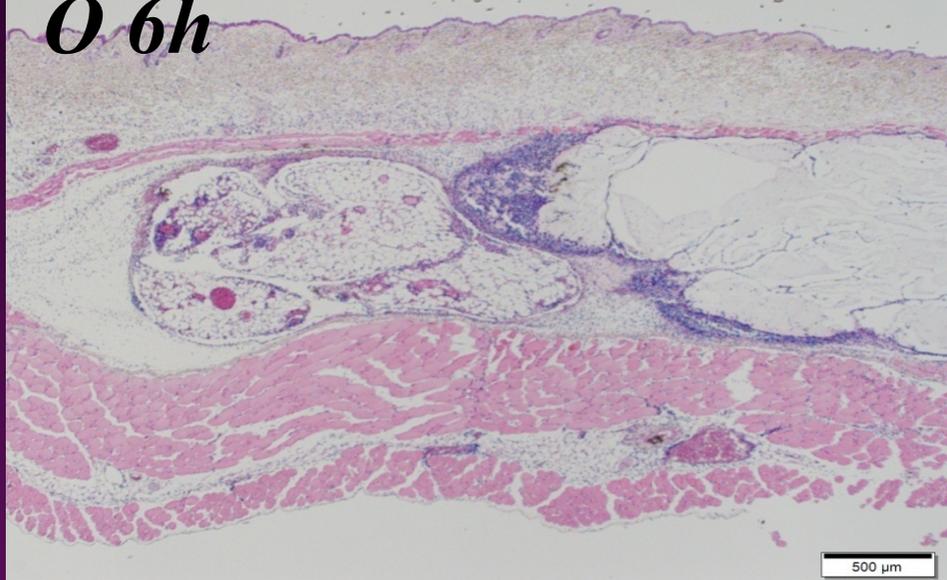
7日目



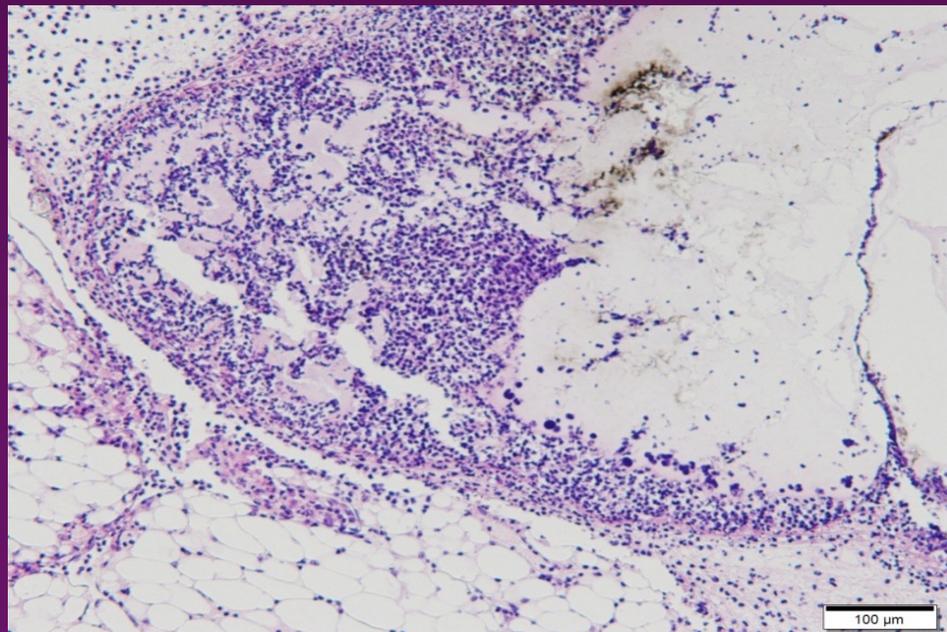
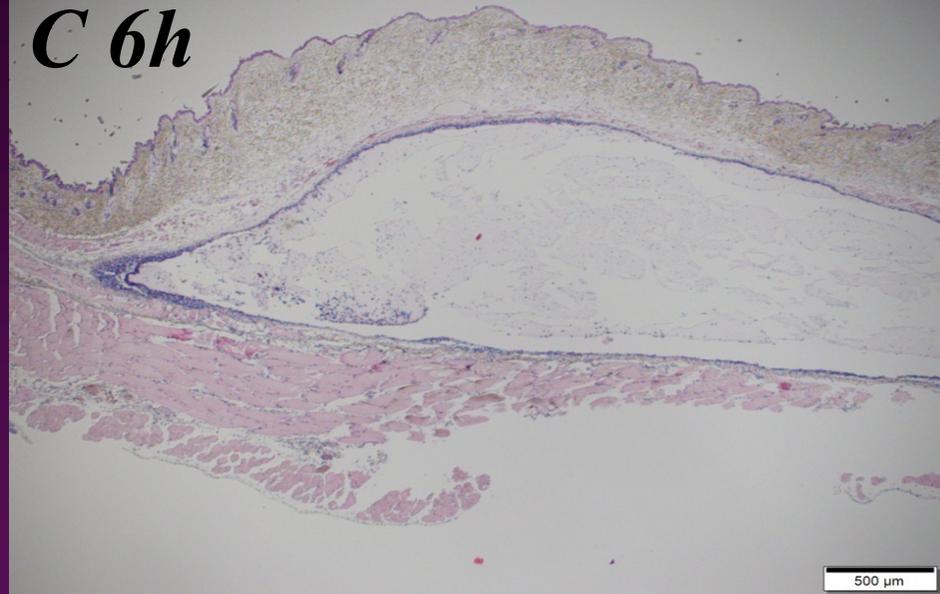
9日目



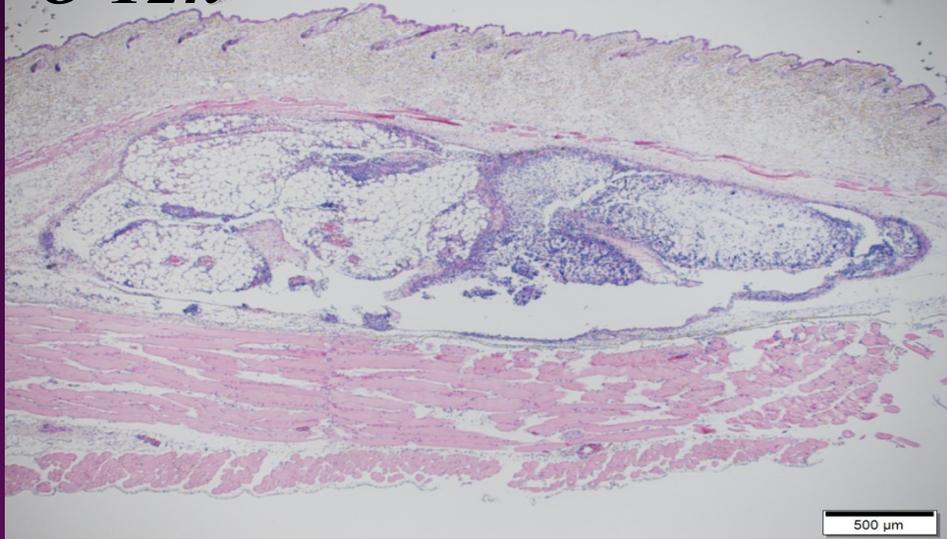
***O 6h***



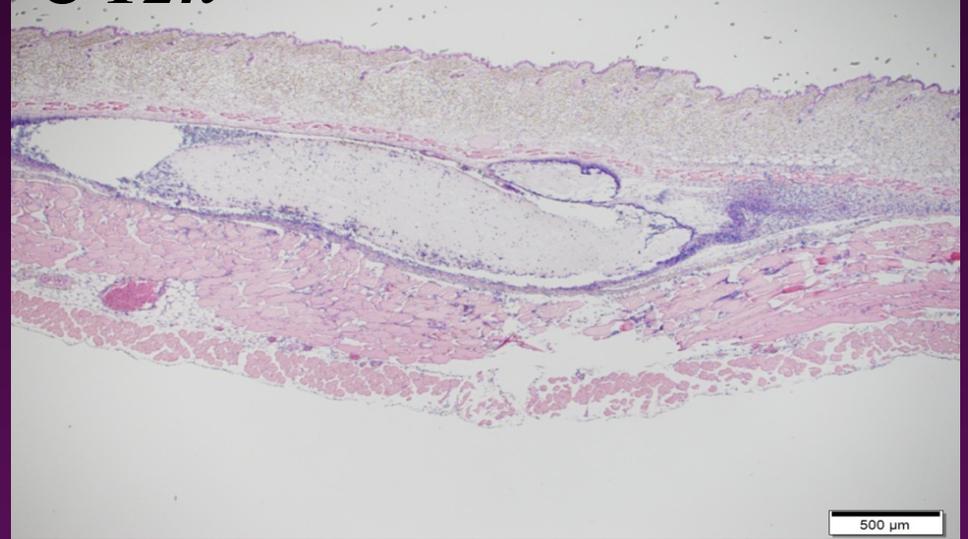
***C 6h***



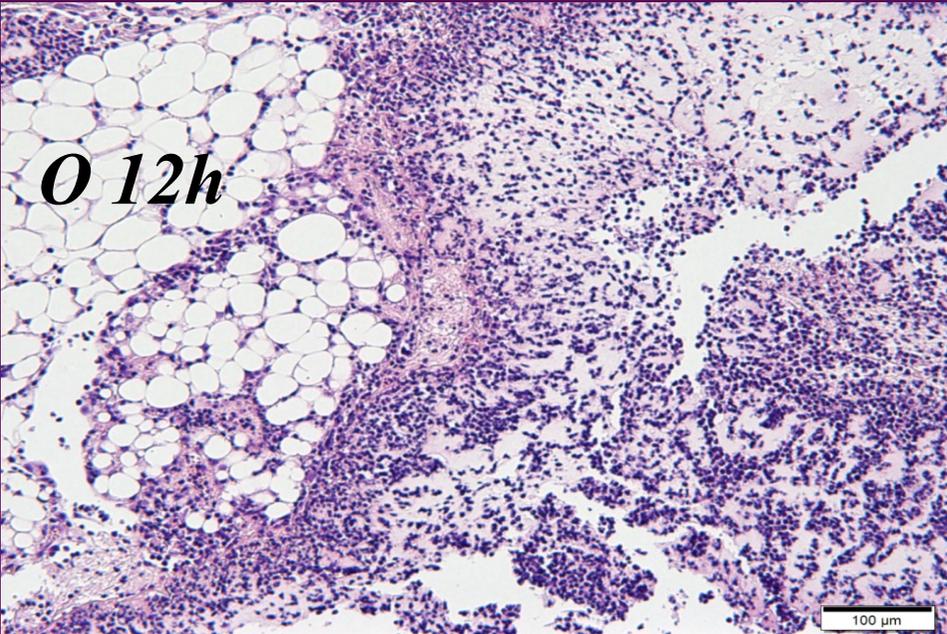
*O 12h*



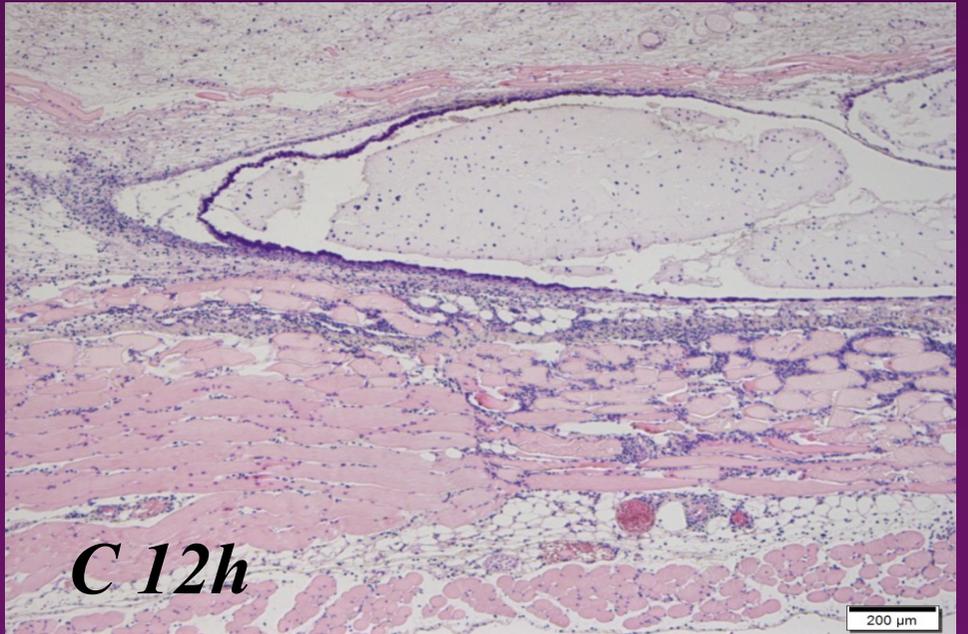
*C 12h*



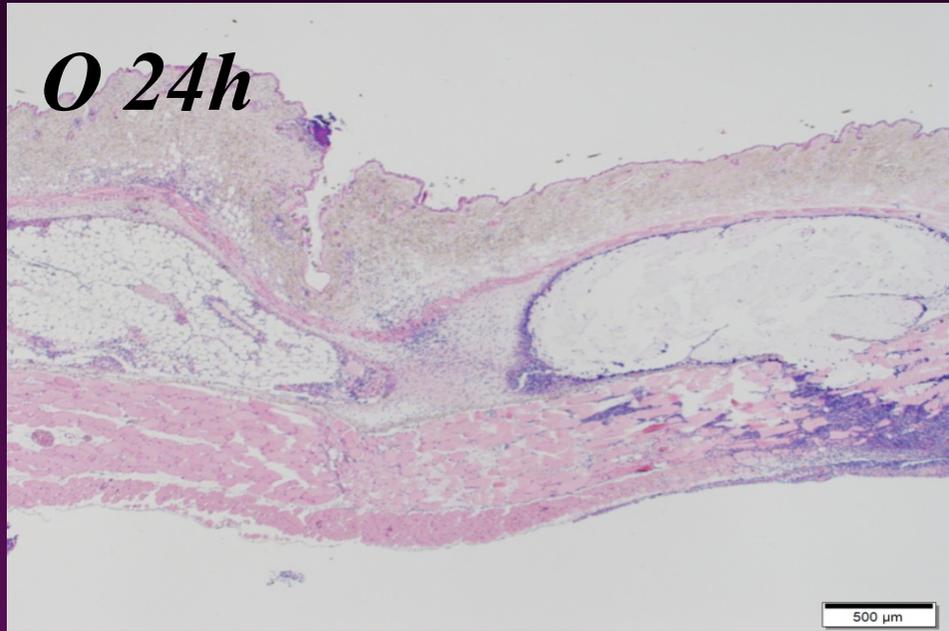
*O 12h*



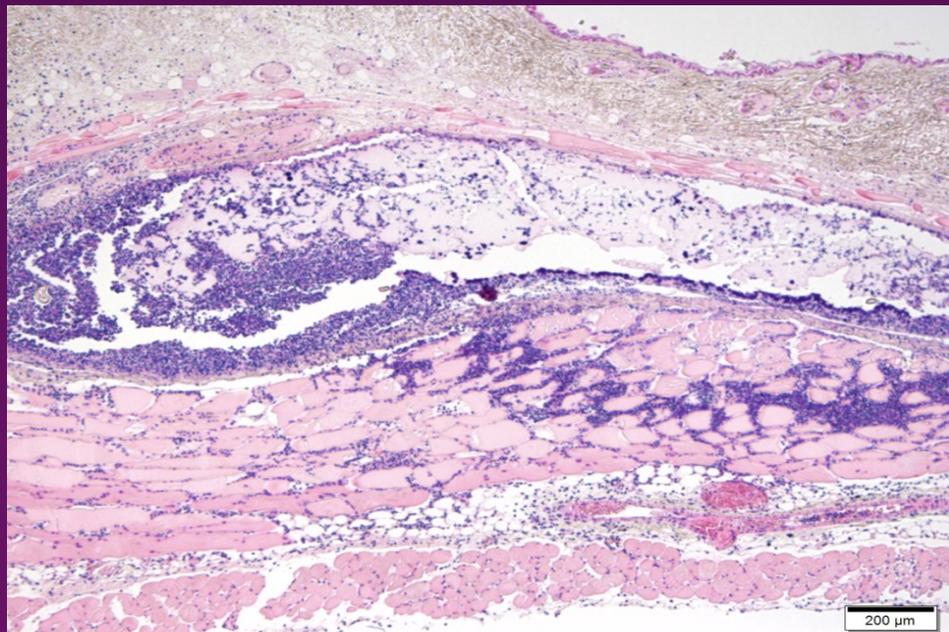
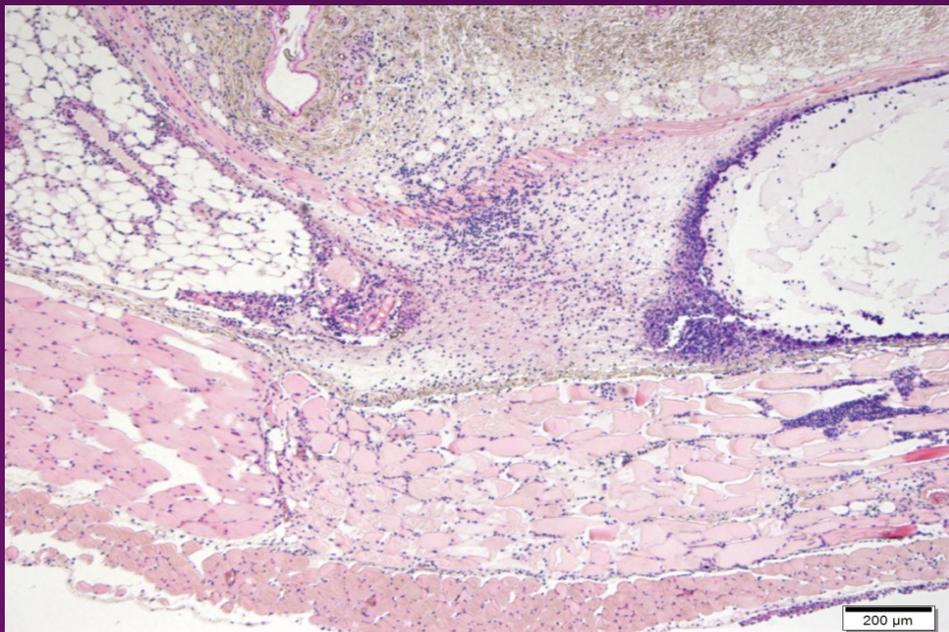
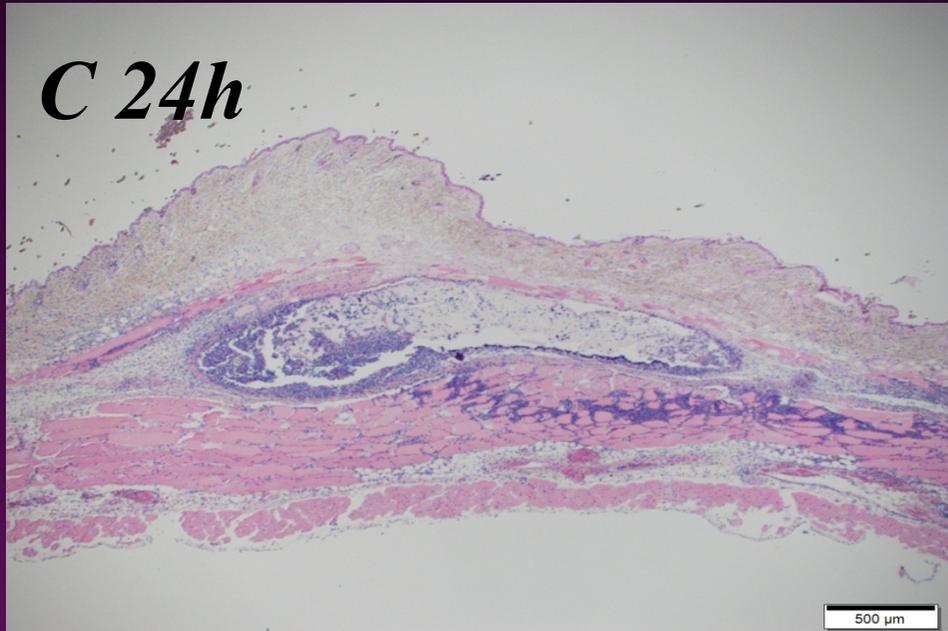
*C 12h*

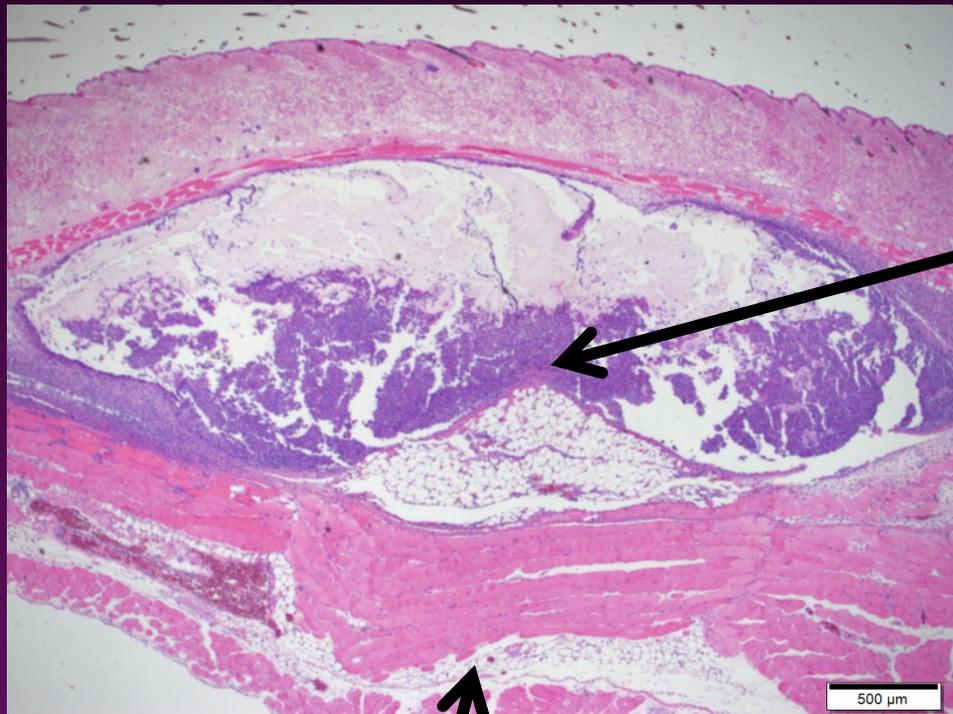


*O 24h*



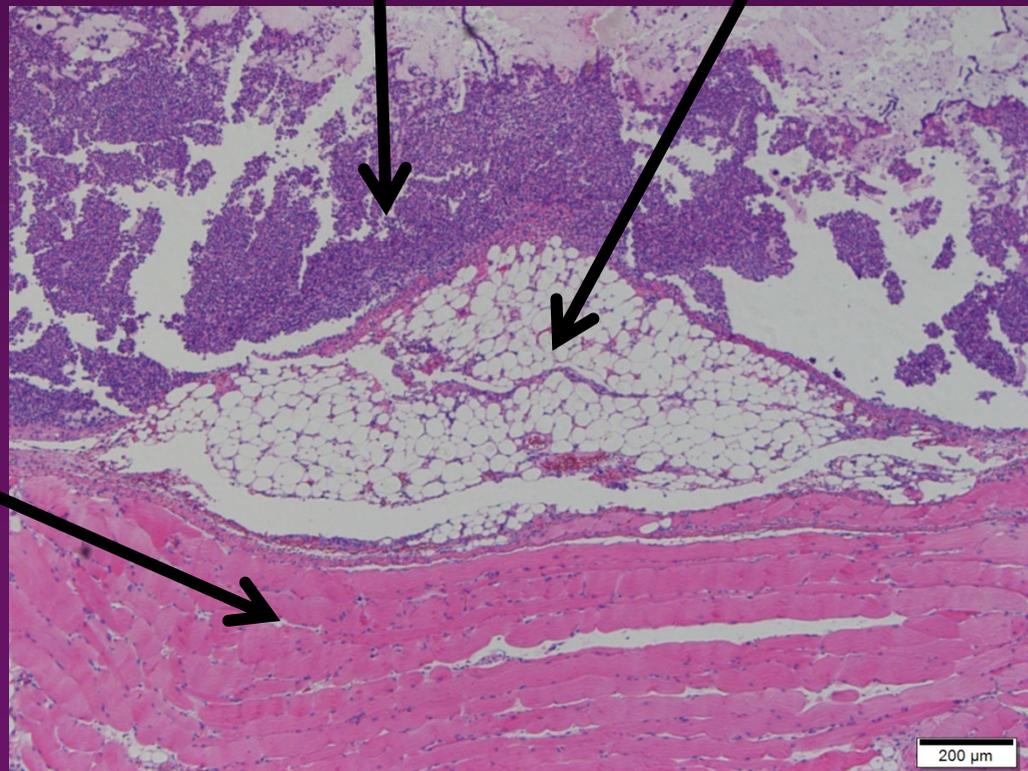
*C 24h*





炎症細胞

大網

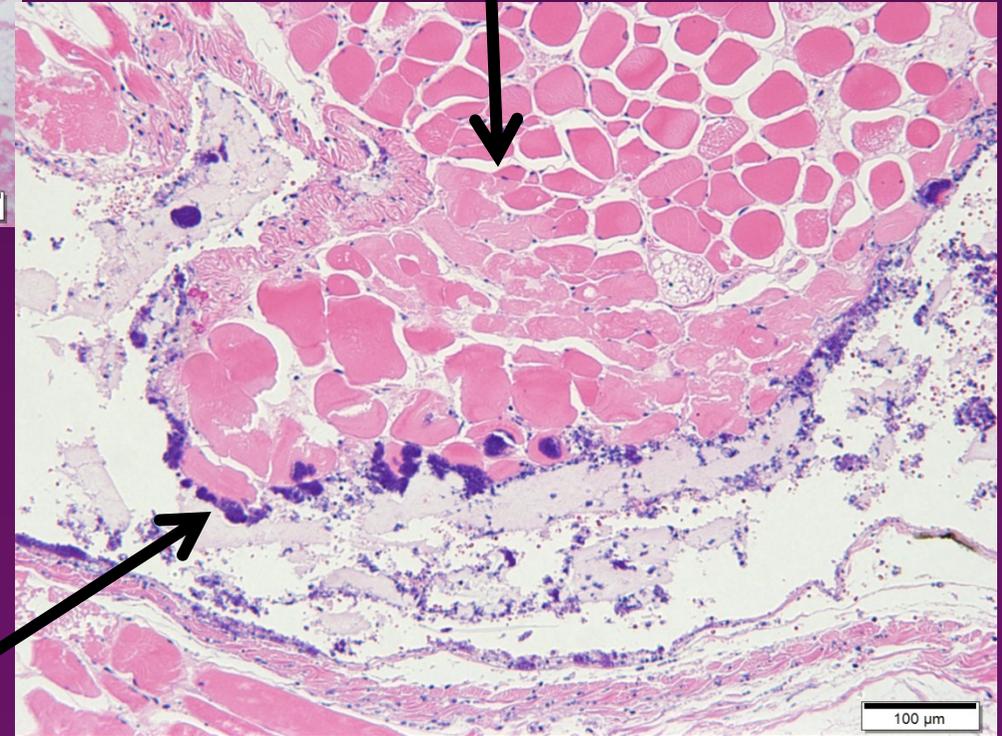
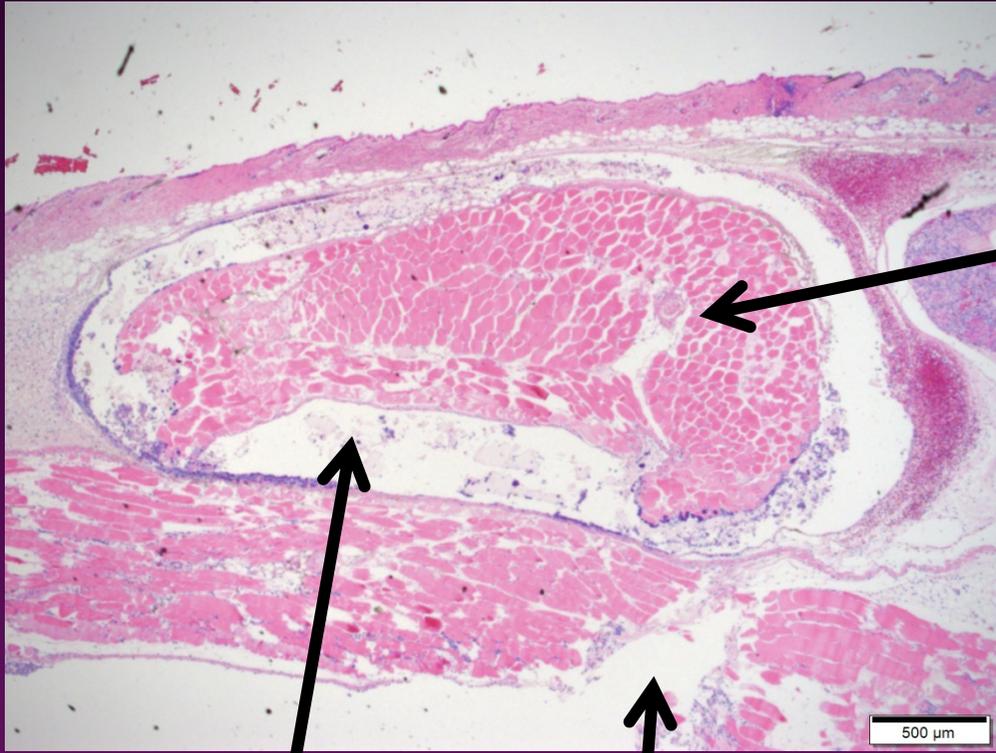


下面の筋層維持

大網24時間

筋弁24時間

筋弁



ブドウ球菌

下面の筋層を破壊

コロニー形成

# 大網

良い状態で治癒させる能力  
各種 *angiogenesis* の存在  
筋弁に比べて感染に強い



## 大網の特徴 2

長い血管茎

豊富な血流

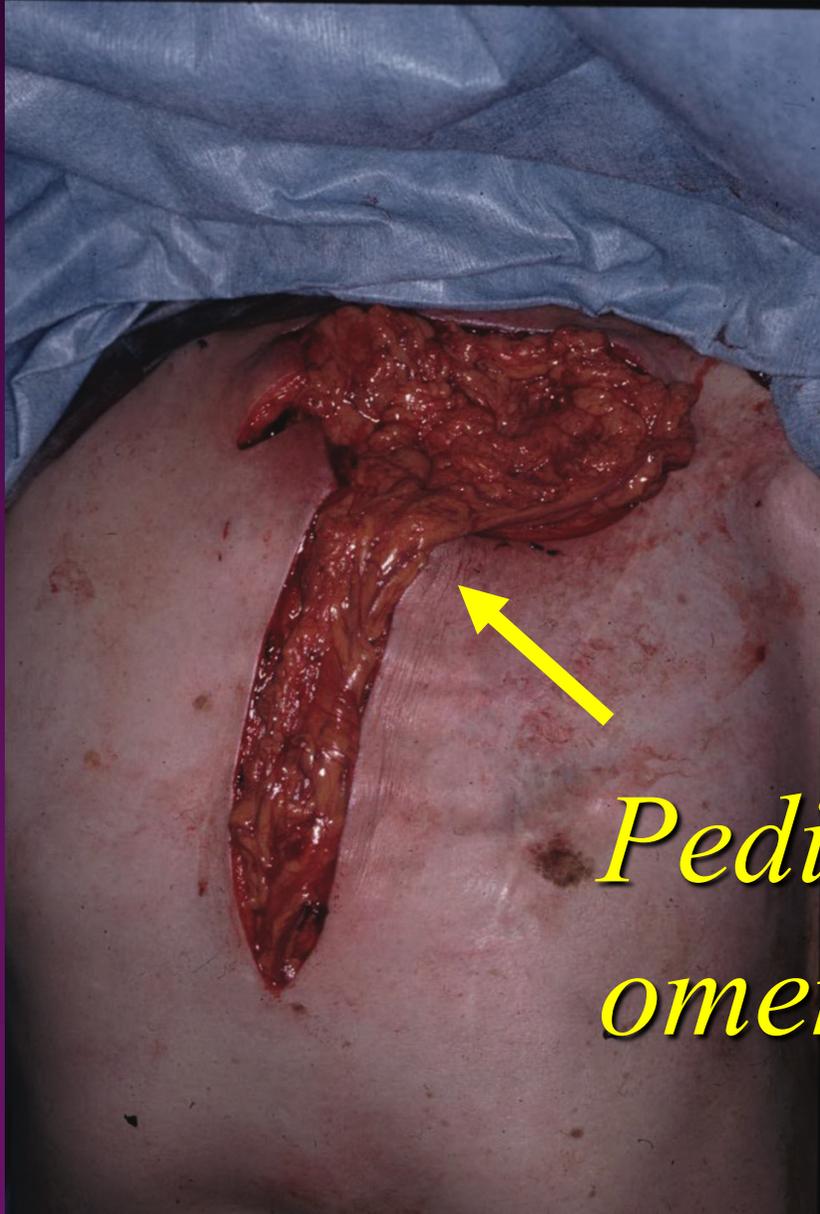
柔軟性があり複雑な欠損を充填可能



72歳 女性

放射線潰瘍

肋軟骨、鎖骨を切除



*Pedicled  
omental flap*



59歲男性 放射線潰瘍

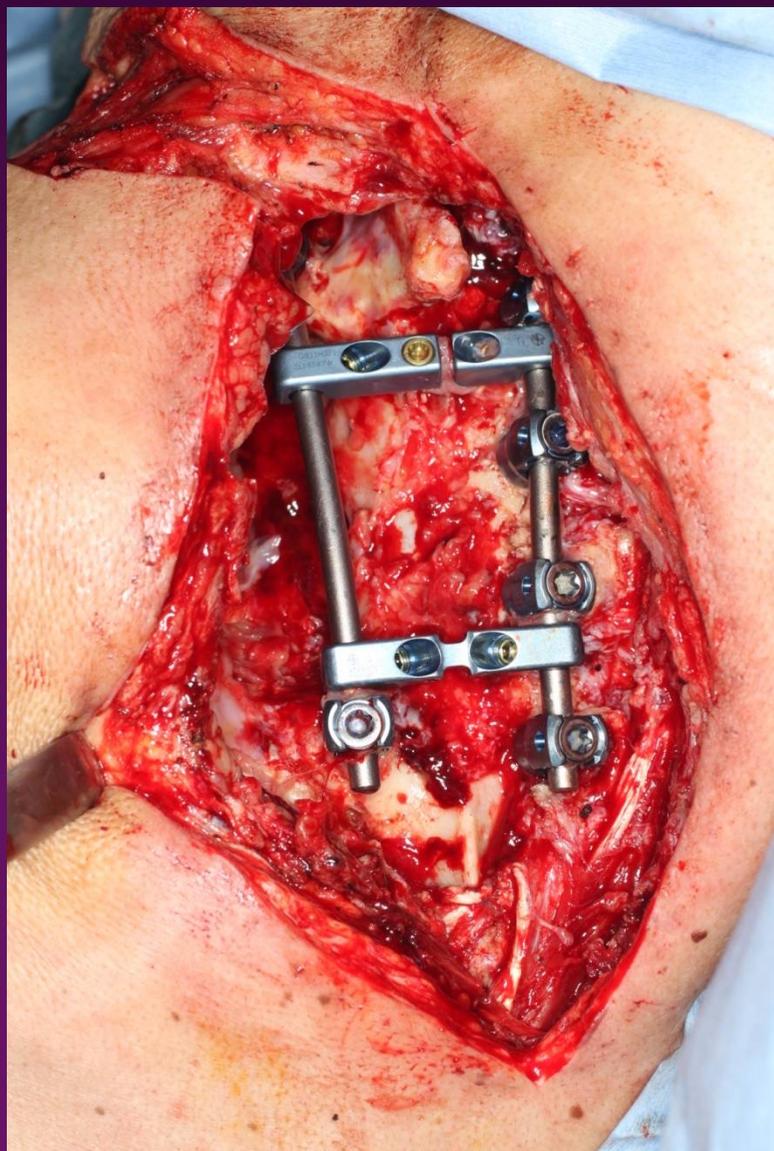
15年前 不明



# 大網+網狀植皮



肺癌の胸椎転移で切除  
その後感染  
装具は外さずそのまま再建



大網



頸部で血管吻合

49歳、男

昭和58年、上咽頭癌で手術

放射線照射 150Gy

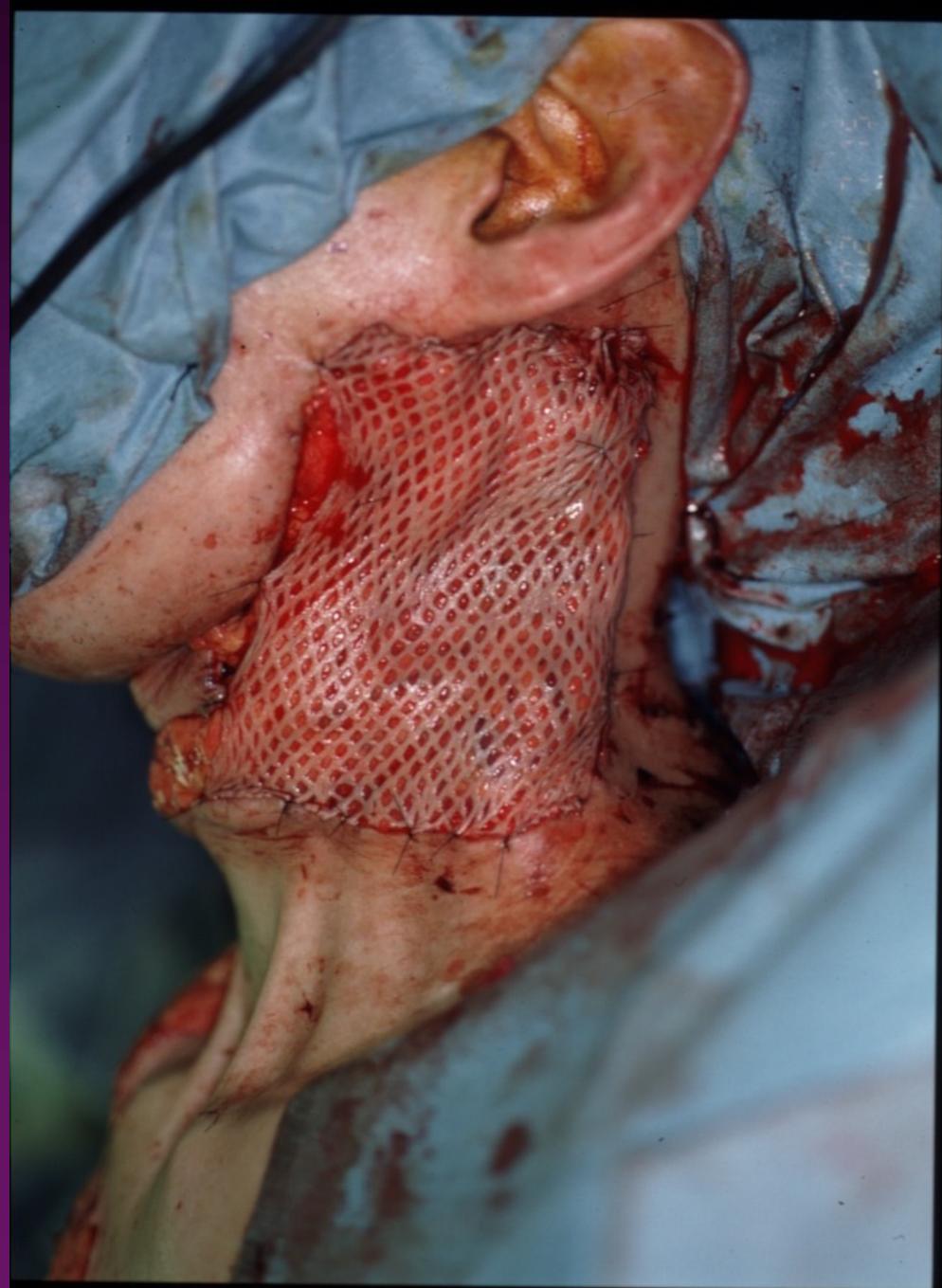
平成15年 頸部放射線潰瘍

左総頸動脈閉塞

右総頸動脈出血









## *162 Omental flaps (1990-2005)*

*53 pedicled flaps    109 free flaps*

*96 male, 66 female*

*50.9 years ( range; 14 – 82 years )*

*78 ( 48.1% )    感染創*

*28 ( 17.3% )    放射線潰瘍*

## 結果 (*partial necrosis of omental flaps*)

有莖大網移植	2/53 例	保存的治療
遊離大網移植	1/109 例	保存的治療
遊離大網移植	1/109 例	追加植皮

# *Complications of donor site*

*No. of patients      treatment*

<i>イレウス</i>	<i>1</i>	<i>open laparotomy</i>
<i>胃穿孔</i>	<i>1</i>	<i>open laparotomy</i>
<i>ヘルニア</i>	<i>1</i>	<i>conservative</i>
<i>創感染</i>	<i>6</i>	<i>conservative</i>

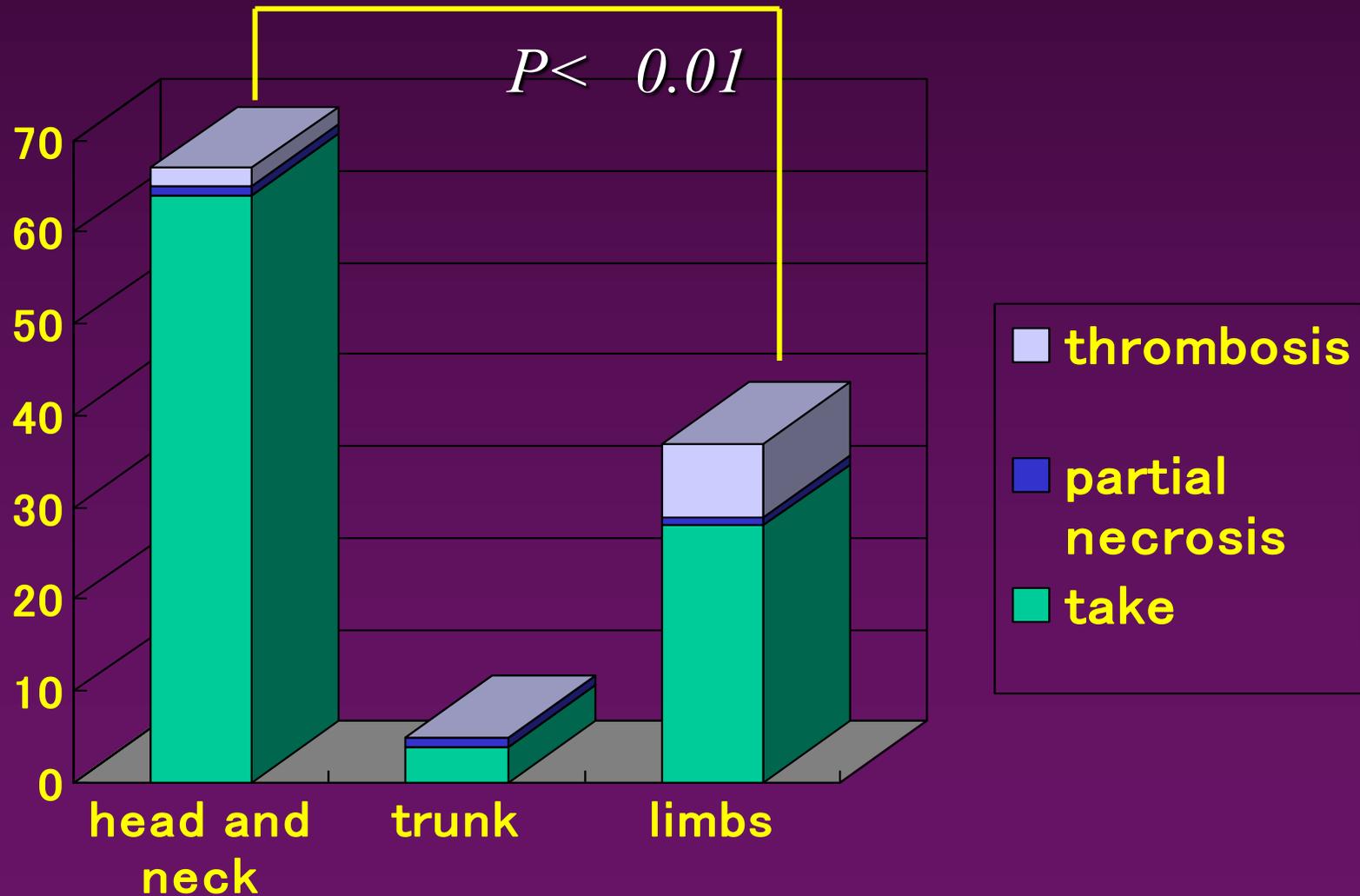
# 結果 ( 109 free omental flaps) 1990~2005

静脈血栓 10例

下肢 8例

頭頸部 2例

# Results of omental flaps



# *Venous thrombosis in free omental flap*

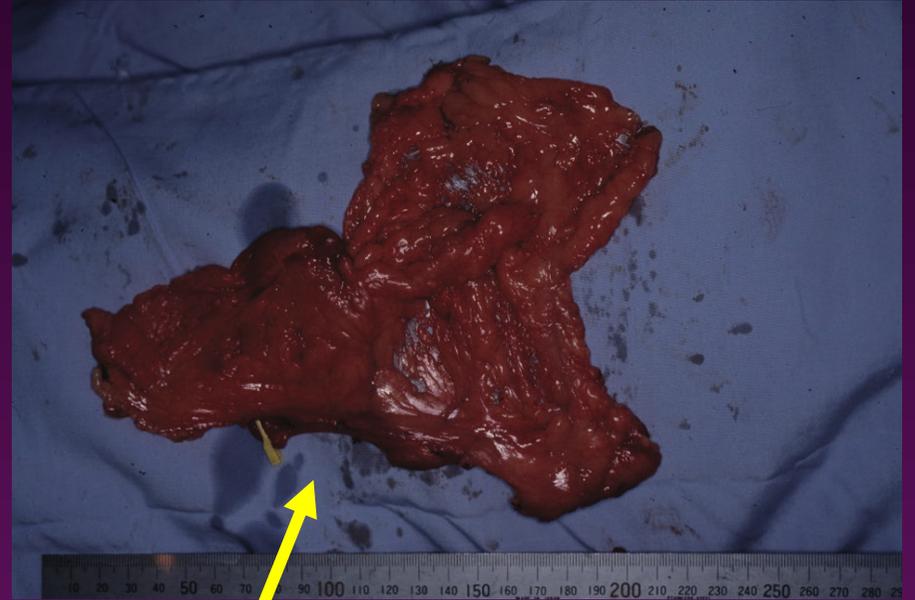
<i>disease</i>	<i>procedure or other flap</i>	<i>final results</i>
中頭蓋底腫瘍	大網	take
脛骨骨髓炎	大網	take
足骨髄炎	大網	take
脛骨骨髓炎	再吻合	take
脛骨骨髓炎	再吻合	take
脛骨骨髓炎	静脈ドレナージ	take
頭蓋骨骨髓炎	広背筋皮弁	take
足潰瘍	植皮	take
下腿潰瘍	植皮	take
下腿潰瘍	cross leg flap	take

*Irregular defect*

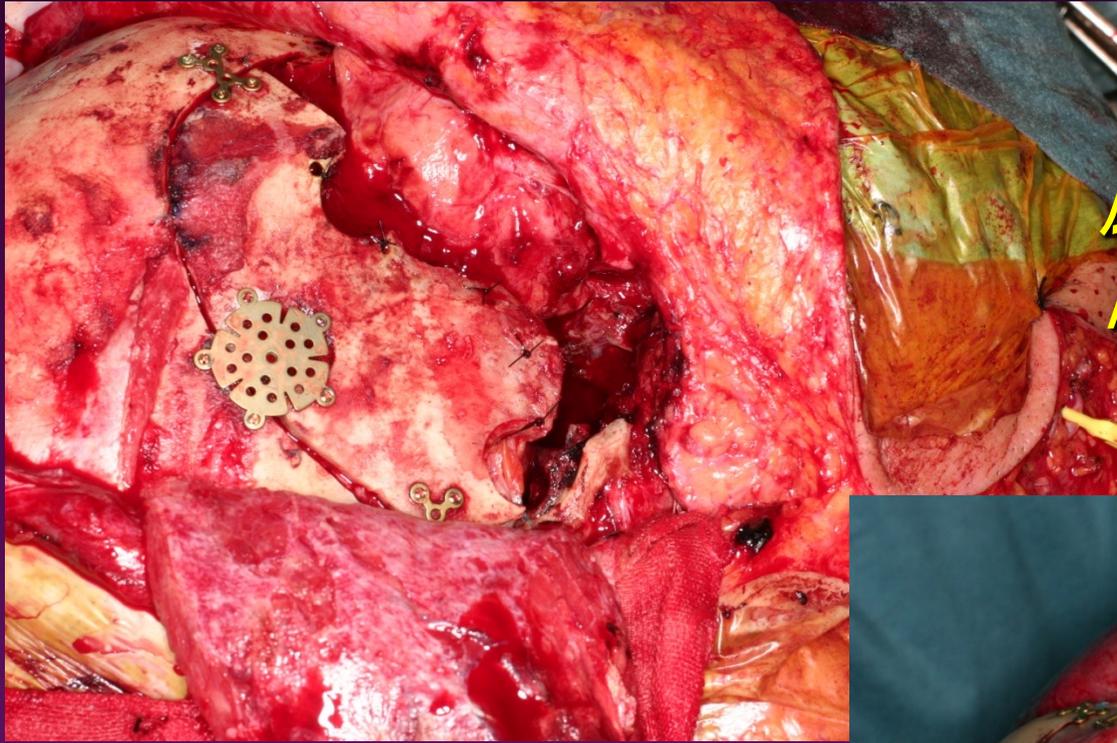


*A 61-year-old man with ulcer  
of right dorsalis pedis*

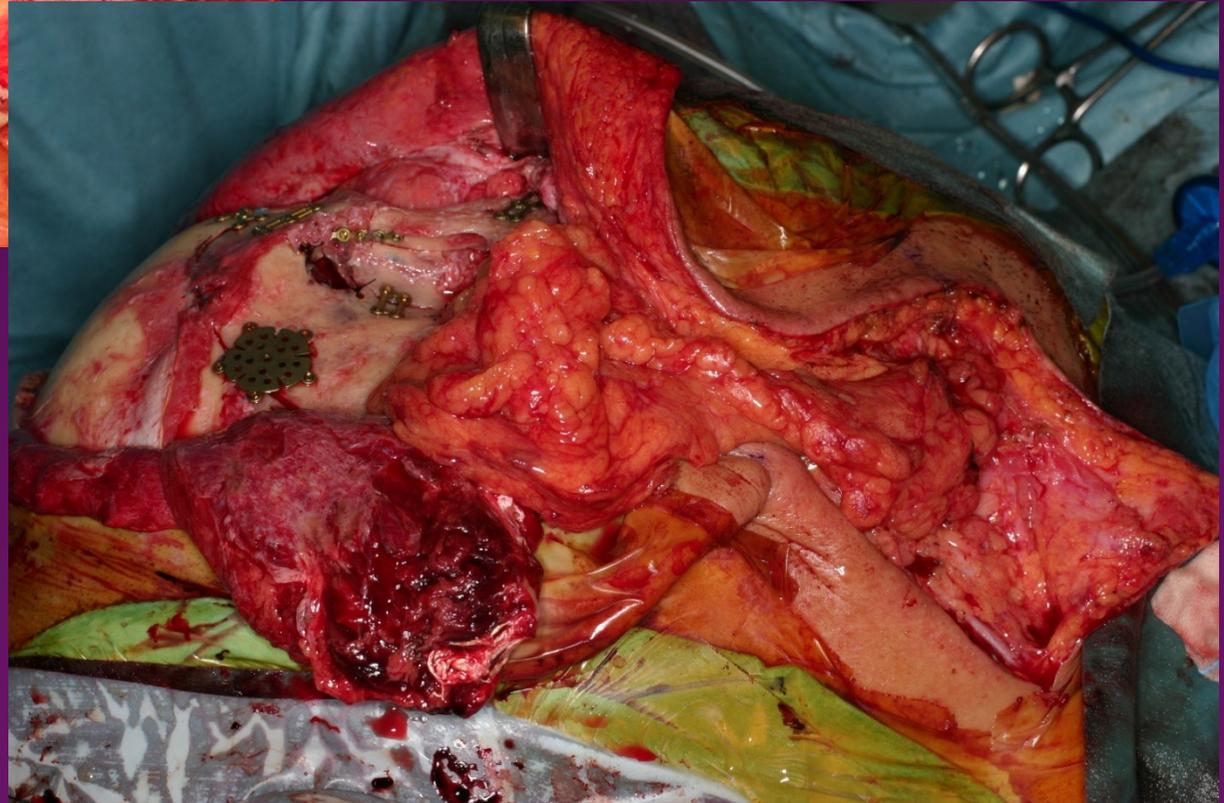




*Omental flap based on  
left gastroepiploic  
vessels*



顔面動脈と外頸静脈に  
吻合

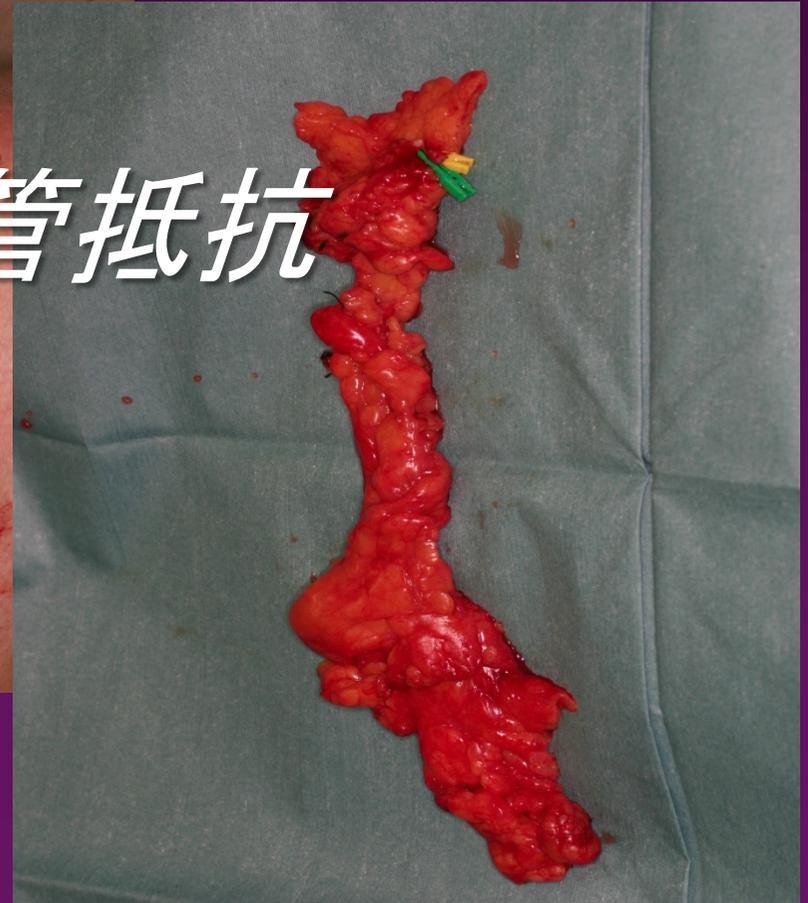


54歳男性

斜台髄膜腫



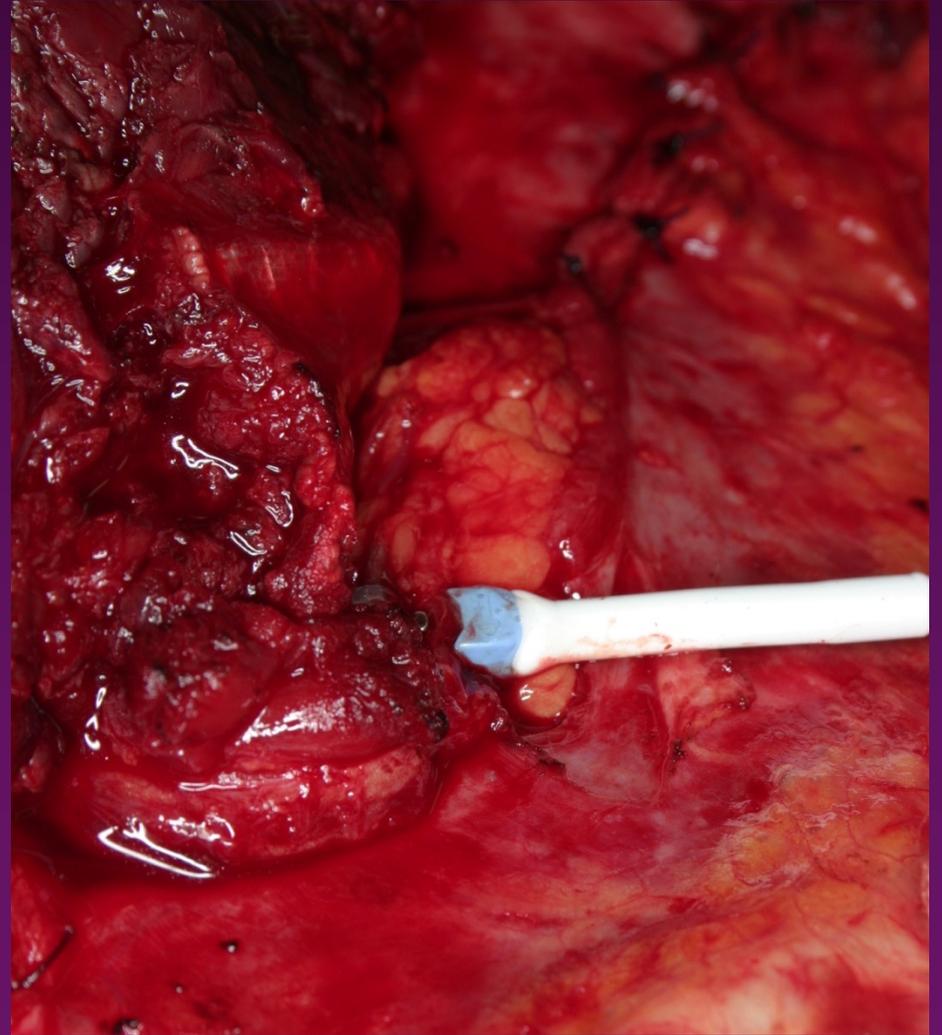
移植床血管と血管抵抗



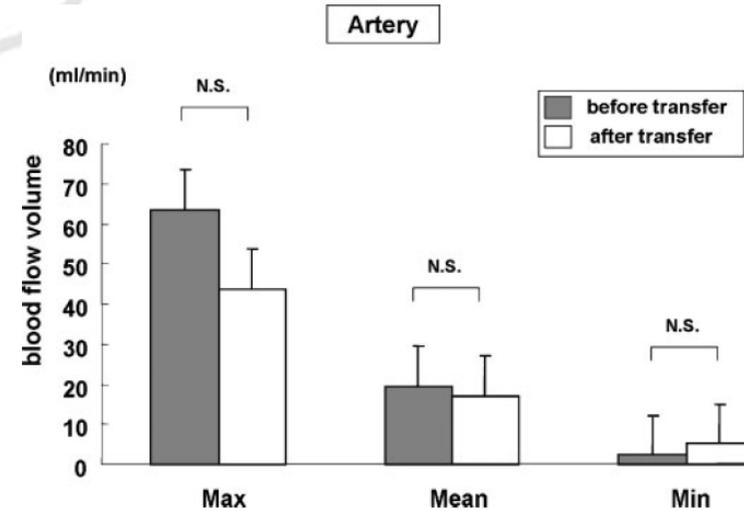
術後2日目

再手術時の大網

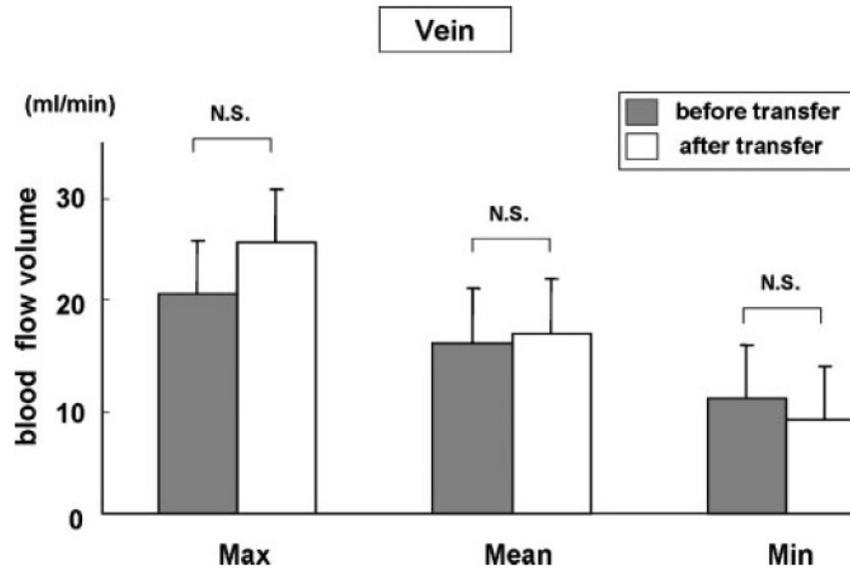
# 血流計の利用



# 血管吻合前後の 血流

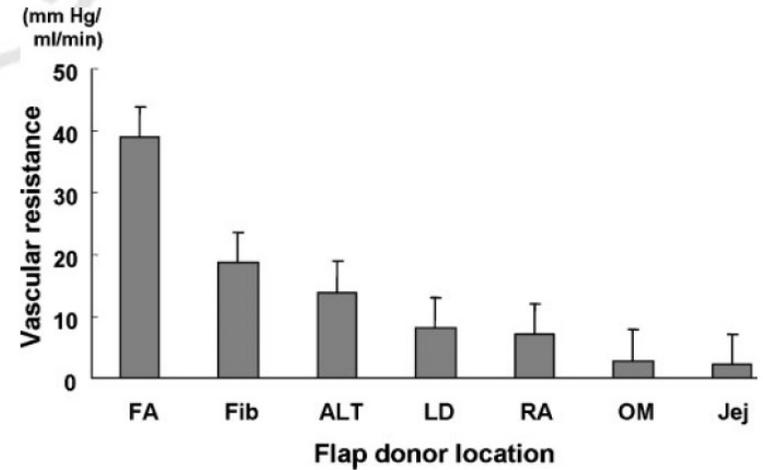


**Figure 4** Comparison of arterial blood flow between before and after transfer, showing no difference (t test). Bars represent means  $\pm$  standard error. NS, not significant.

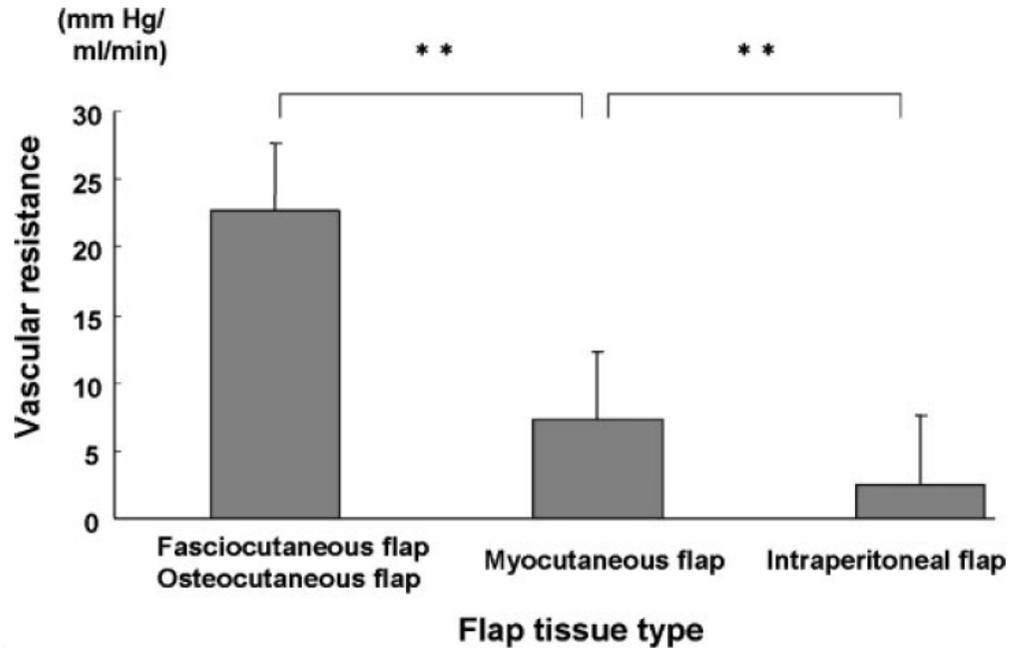


**Figure 5** Comparison of venous blood flow between before and after transfer, showing no difference (t test). Bars represent means  $\pm$  standard error.

# 各種皮弁抵抗



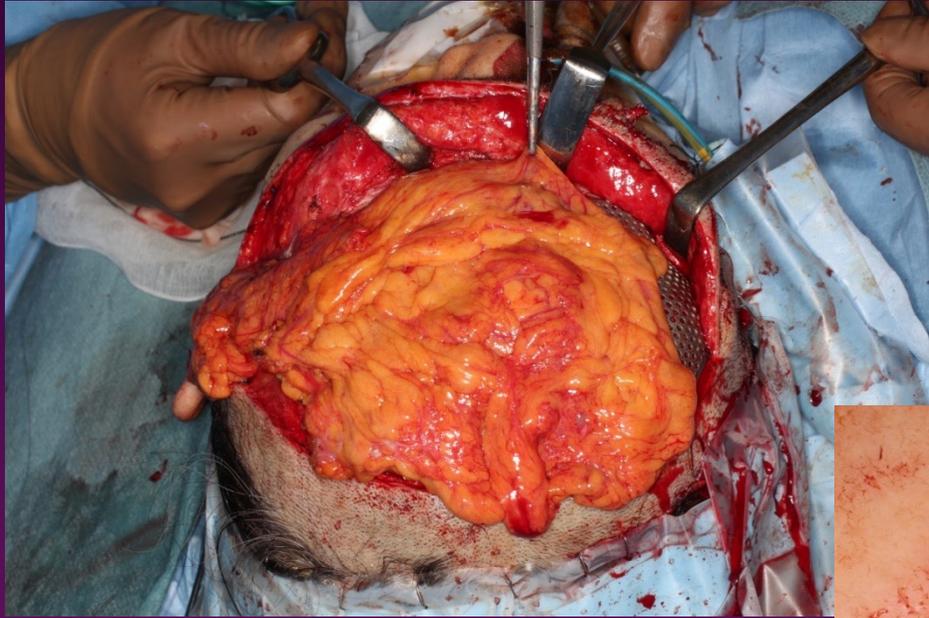
**Figure 8** Comparison of vascular resistance of the flap by flap donor sites. Bars represent means  $\pm$  standard error. Jejunal (Jej) flaps and omental (OM) flaps had low vascular resistance, with vascular resistance progressively increasing for rectus abdominis (RA) myocutaneous flaps, latissimus dorsi (LD) myocutaneous flaps, anterolateral thigh (ALT) flaps, fibula (Fib) osteocutaneous flaps, and forearm (FA) flaps.



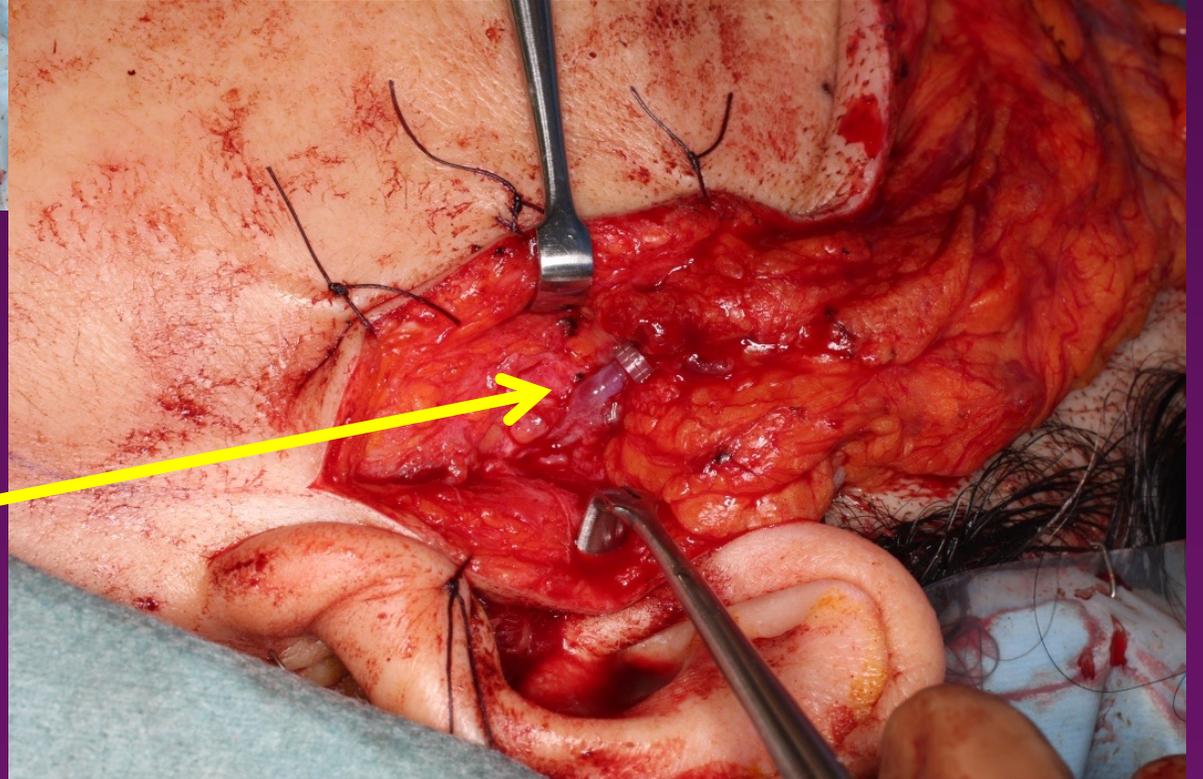
筋膜皮弁・骨皮弁 > 筋皮弁  
> 腹腔内組織

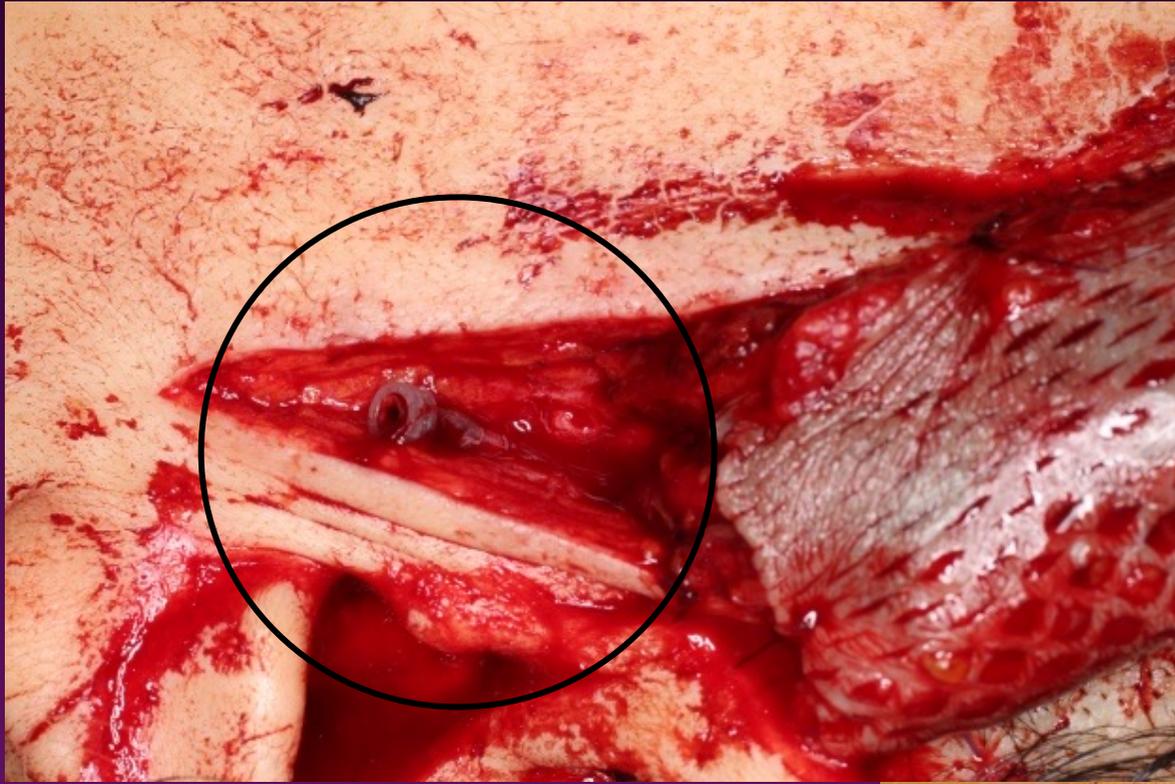
移植床静脈の選択

腹腔内組織(大網など)は太い静脈に

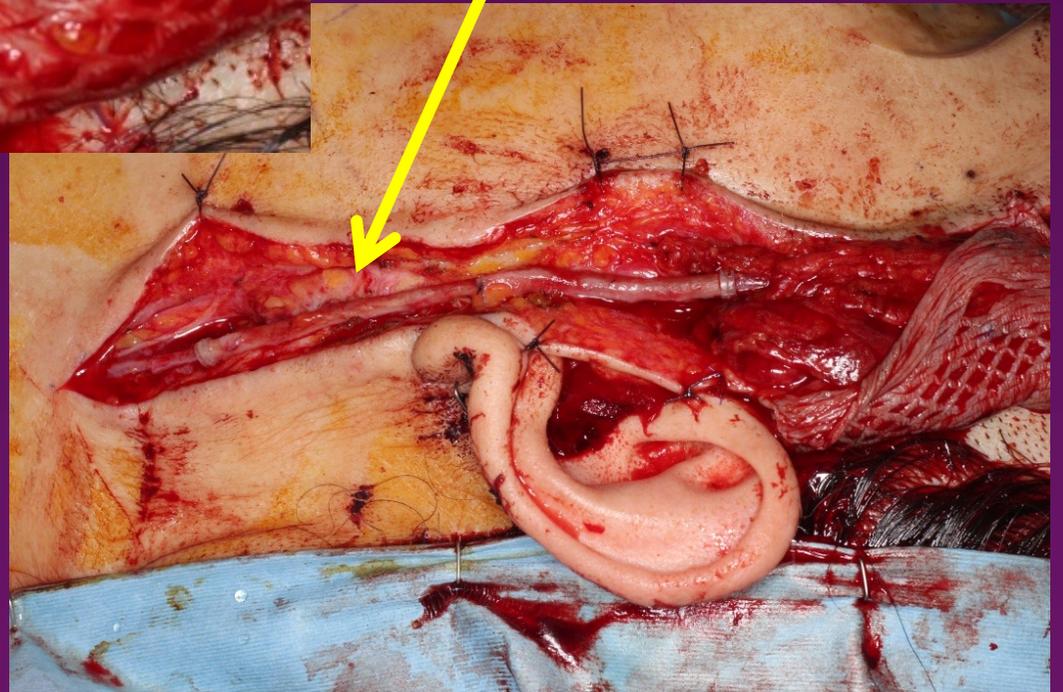


浅側頭静脈：  
細い静脈

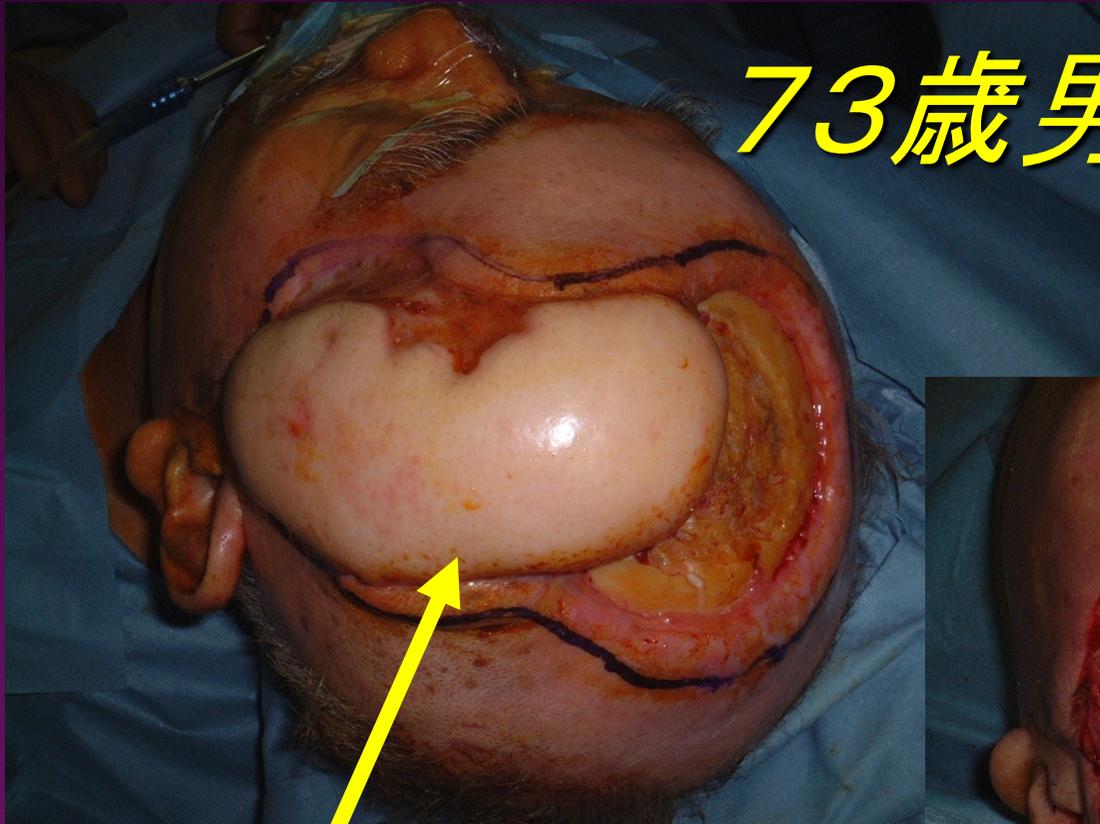




# 靜脈移植



73歳男性 1ヶ月 40Gy



広背筋皮弁





大網+網狀植皮

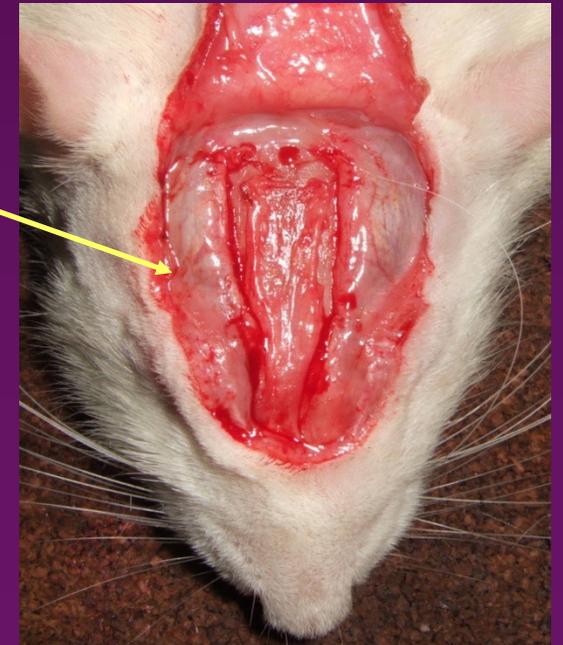
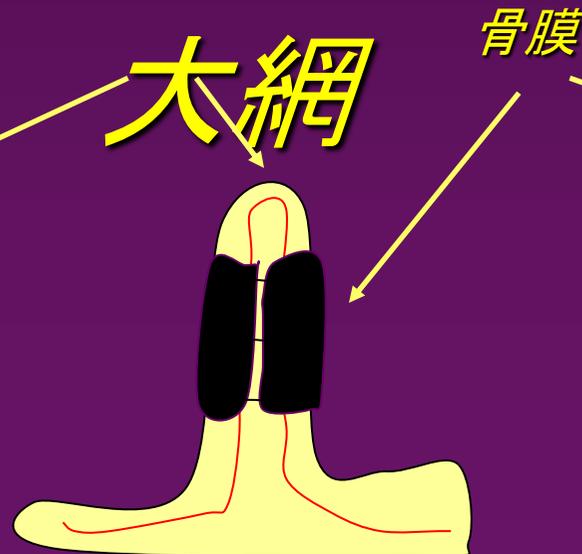
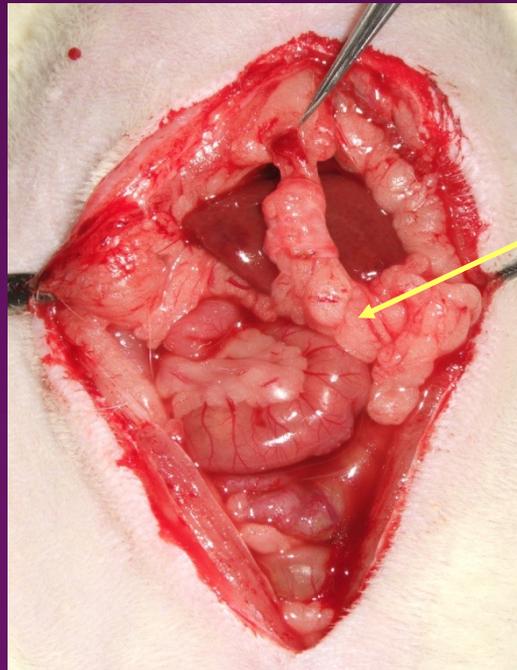
大網＝脂肪＋血管＋????

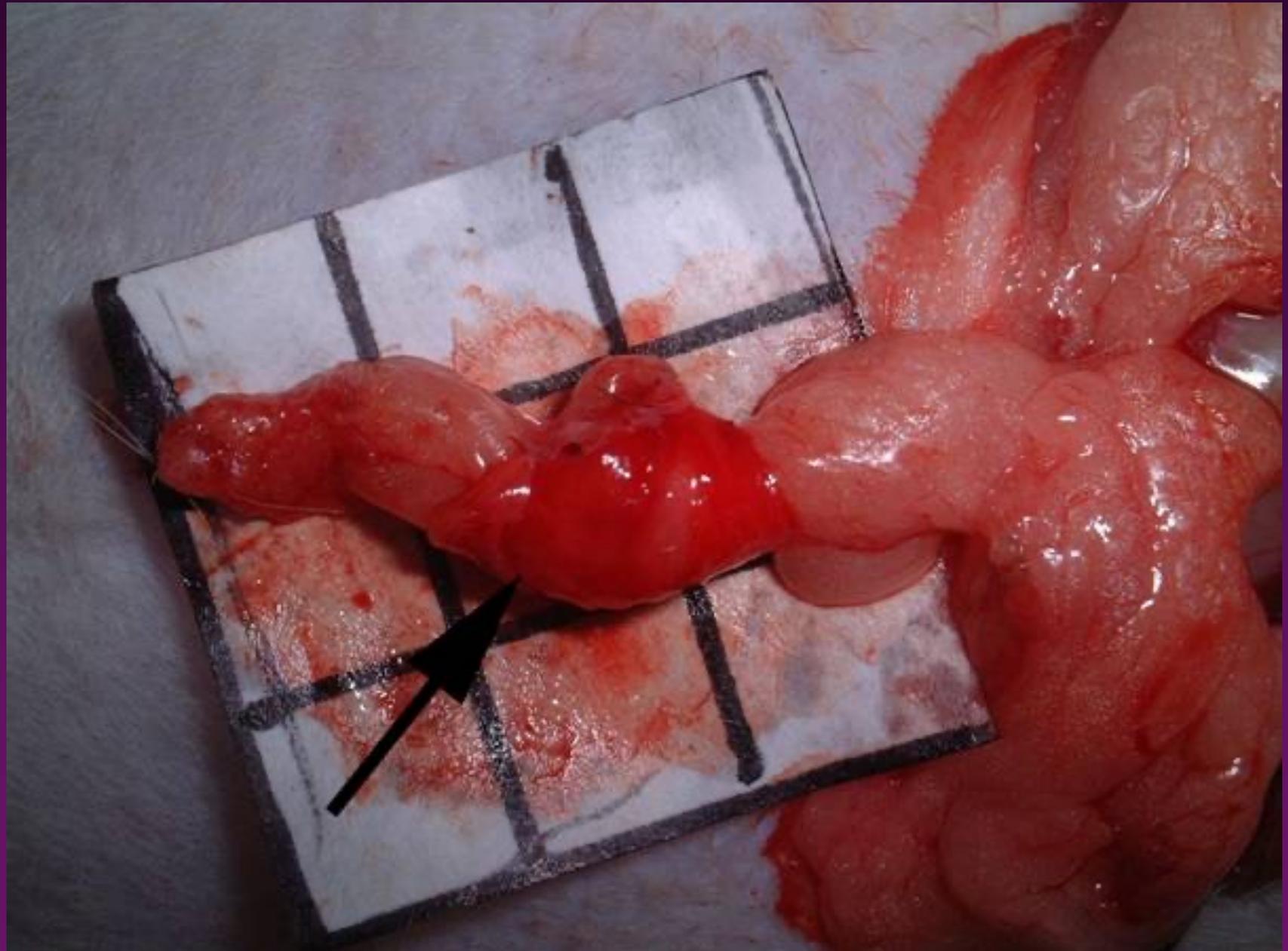


大網に幹細胞はあるのか？

# 材料と方法

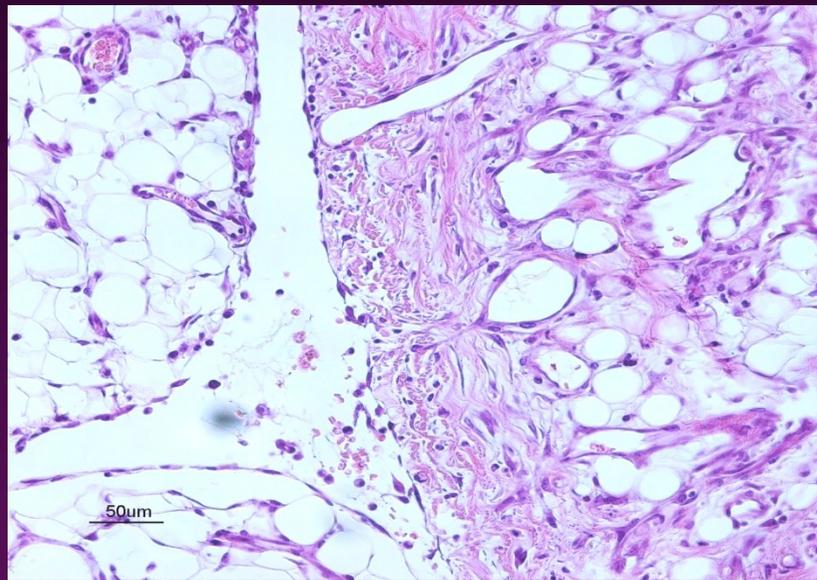
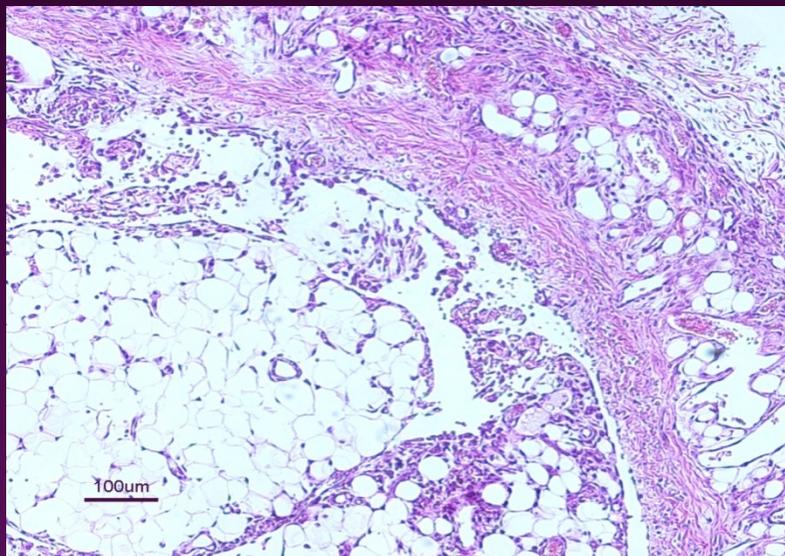
- SDラット オス 生後9週齢 約300g n=27
- 骨膜と大網を1日後から9日後まで採取
- HE染色およびギムザ染色にて組織学的に検討
- コッサ染色にてカルシウムの沈着を確認



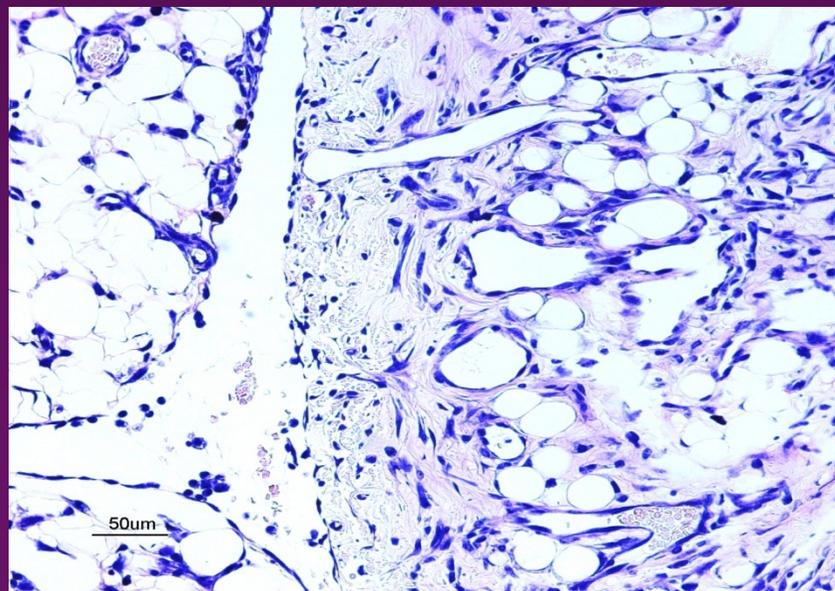
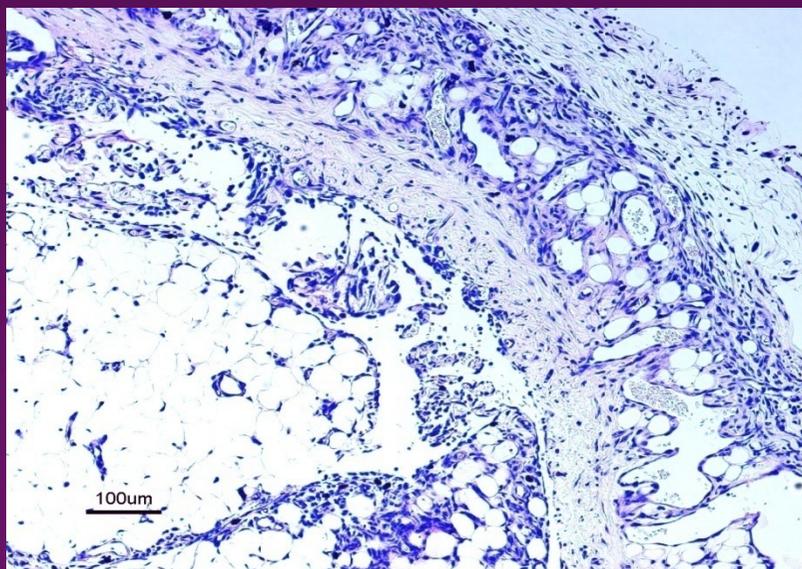


1日後

HE染色

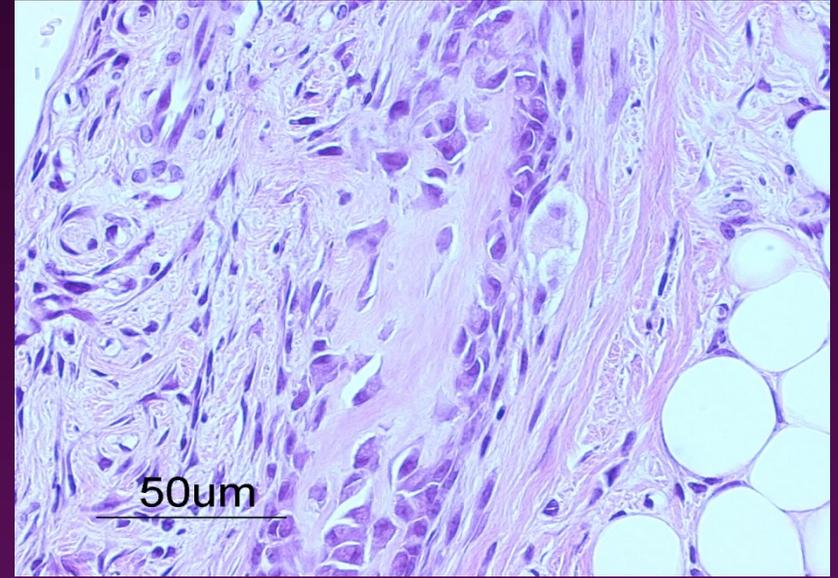
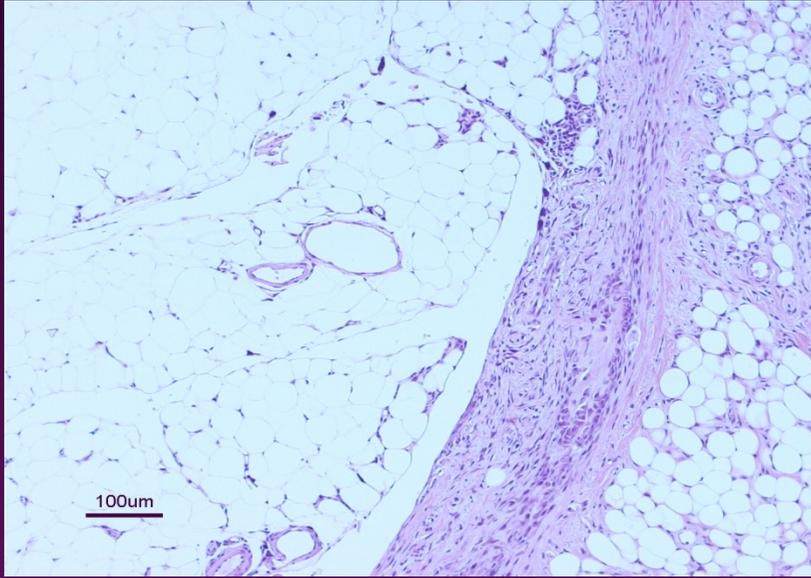


ギムザ染色

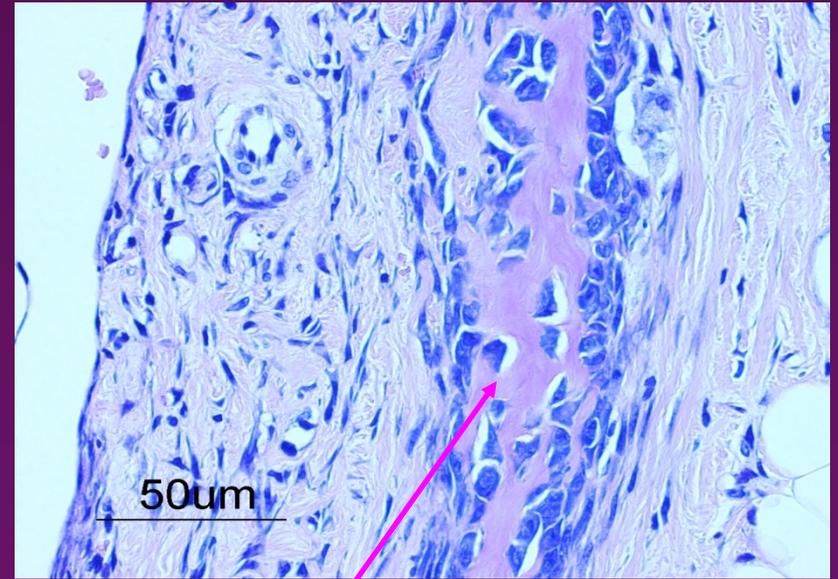
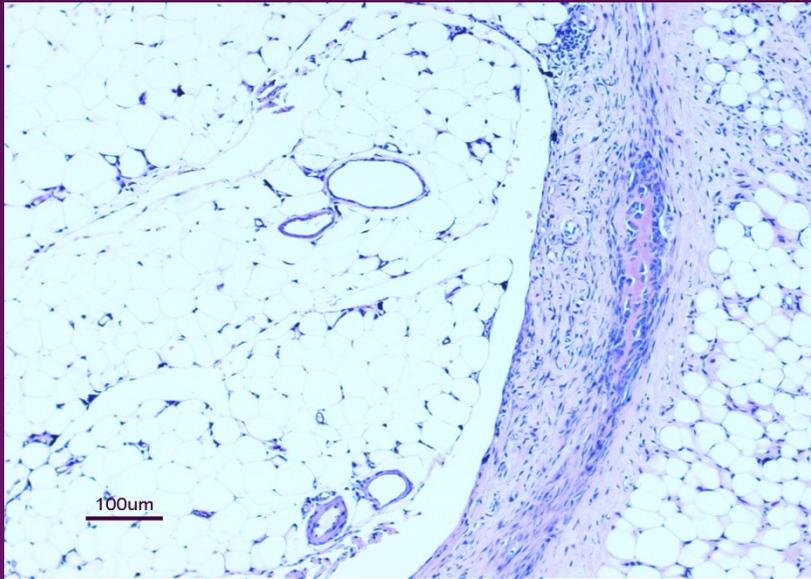


3日後

HE染色



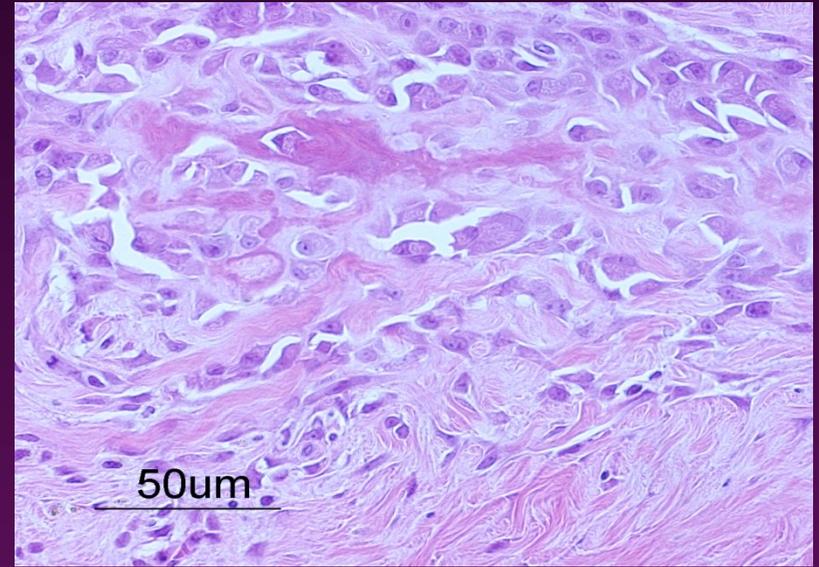
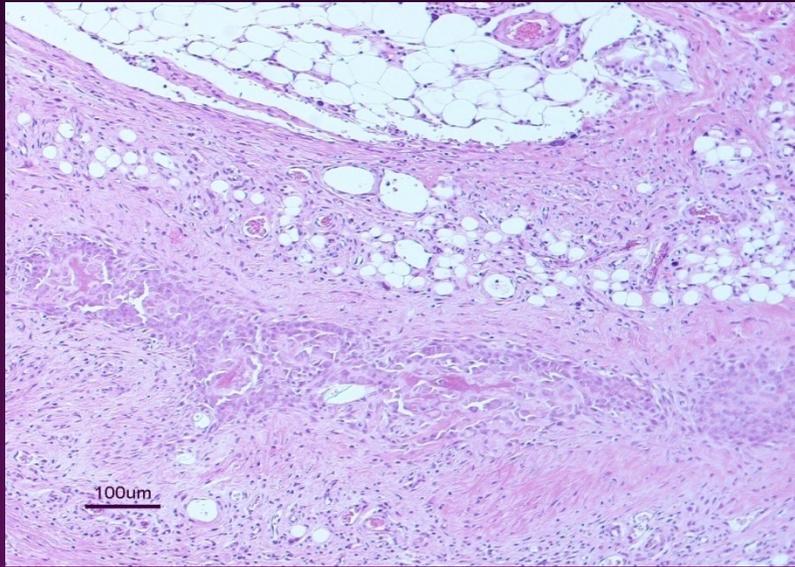
ギムザ染色



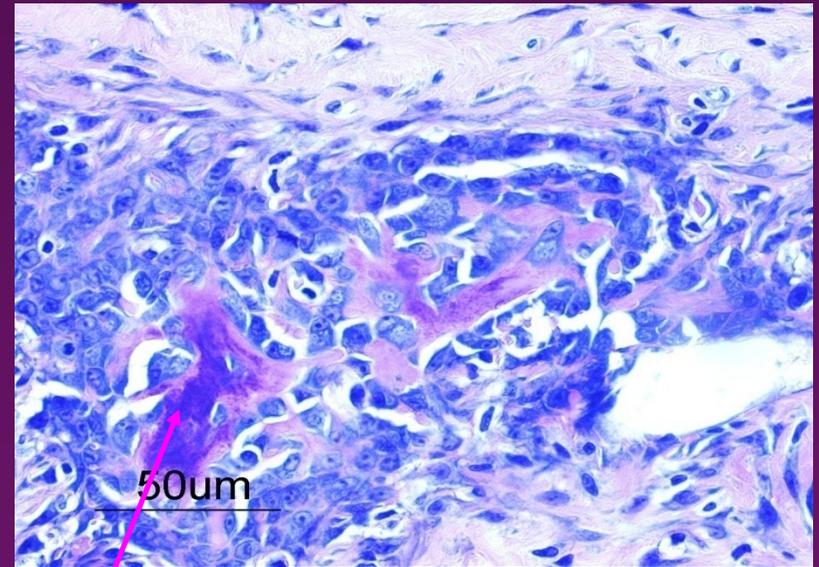
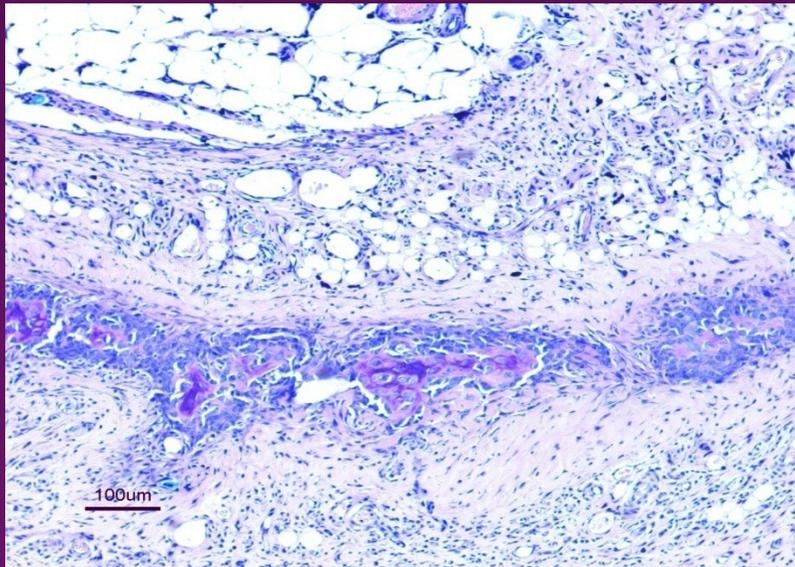
類骨の形成

5日後

HE染色



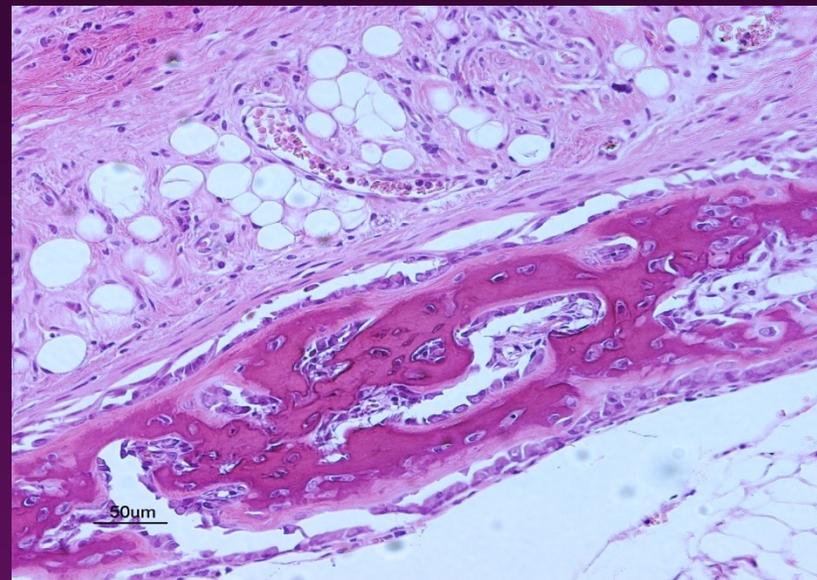
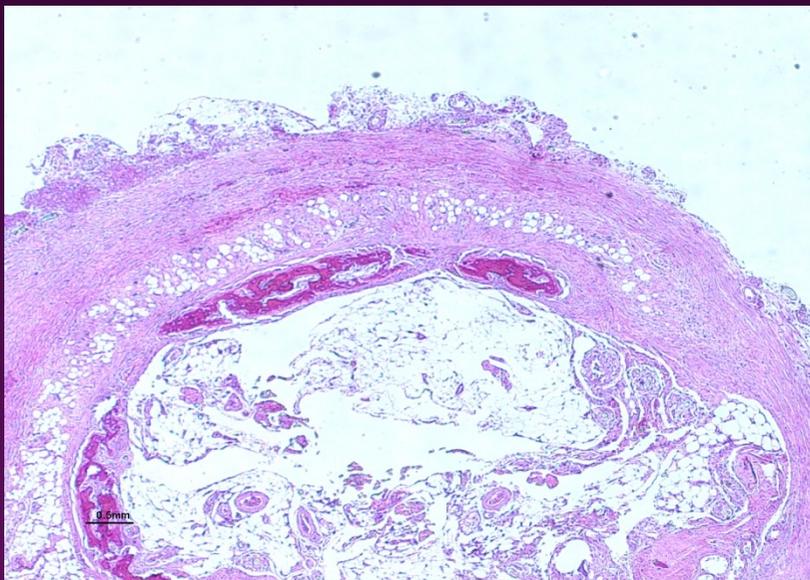
ギムザ染色



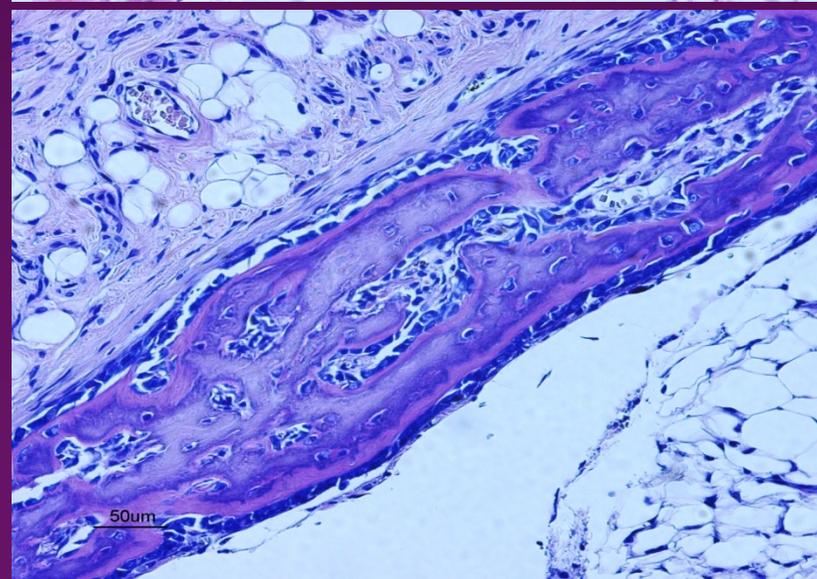
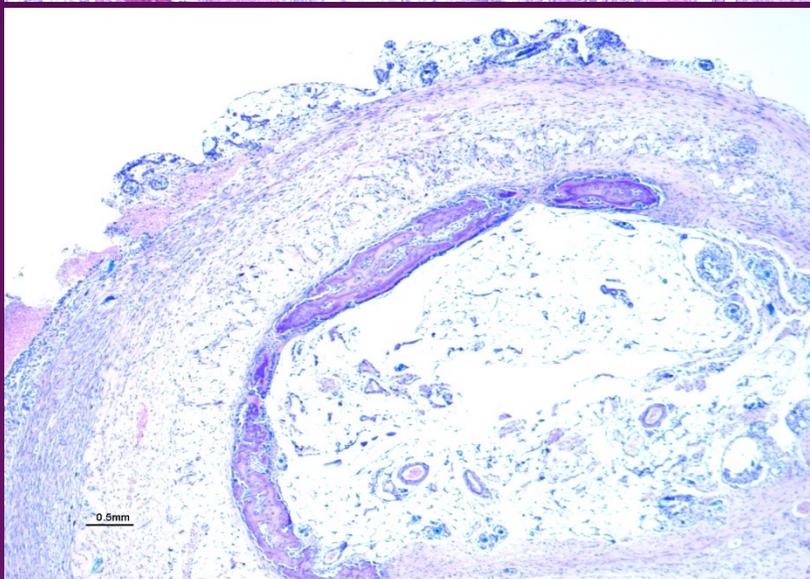
骨の形成

7日後

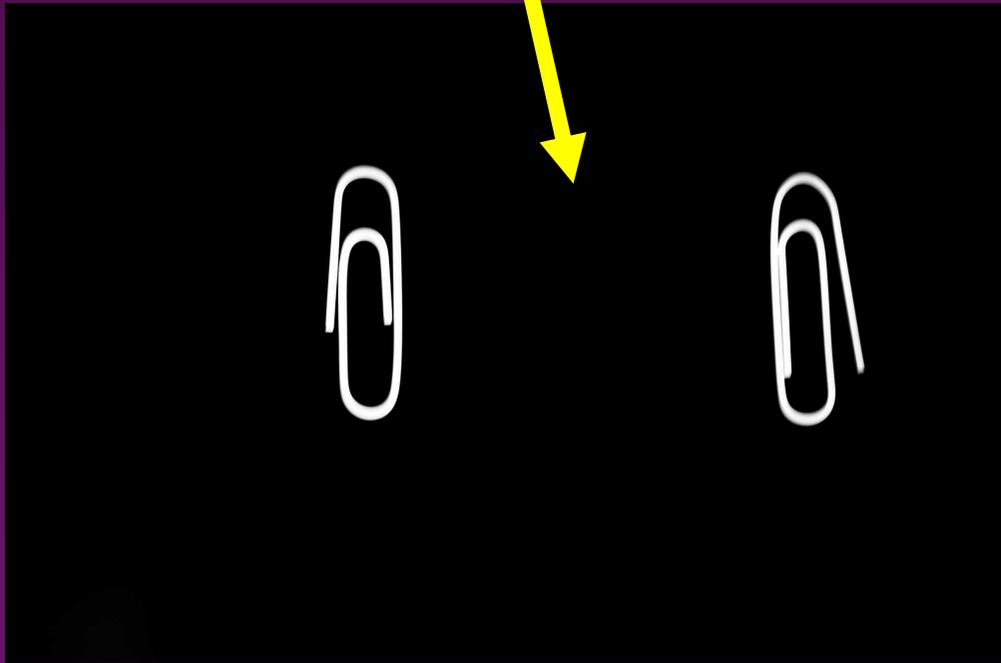
HE染色



ギムザ染色



骨膜のみ

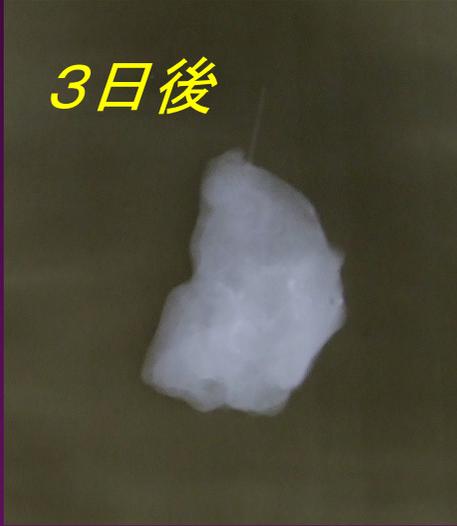


骨再生

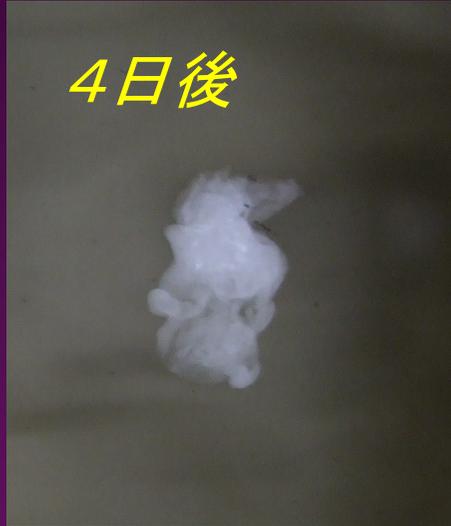


# 軟X線撮影

3日後



4日後



5日後



6日後



7日後

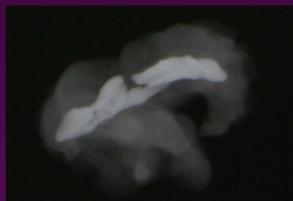
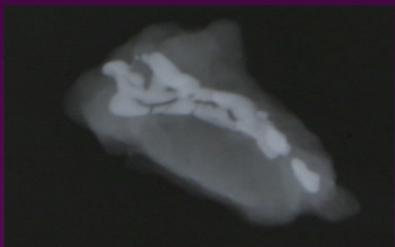


- ・ 類骨の形成が3日後、骨の形成が5日後と、早期に骨新生を認めた
- ・ 骨膜の由来と同様に、膜性骨化にて骨形成がおきていた

頭蓋骨骨膜 + 大網で1週間以内に骨形成が開始される

→ 長期的には新生骨はどうか

# 軟X線像



1m

2m

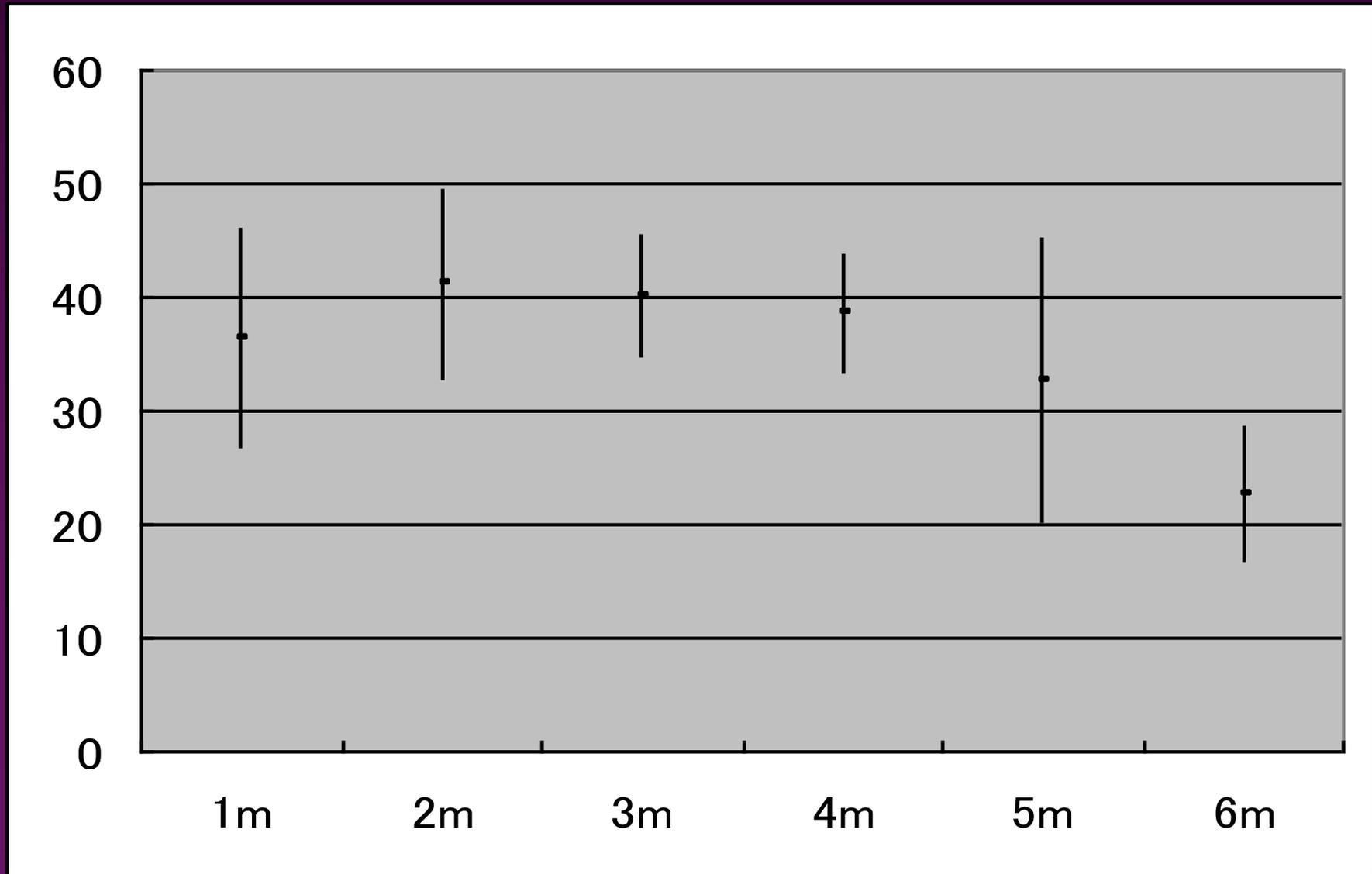
3m

4m

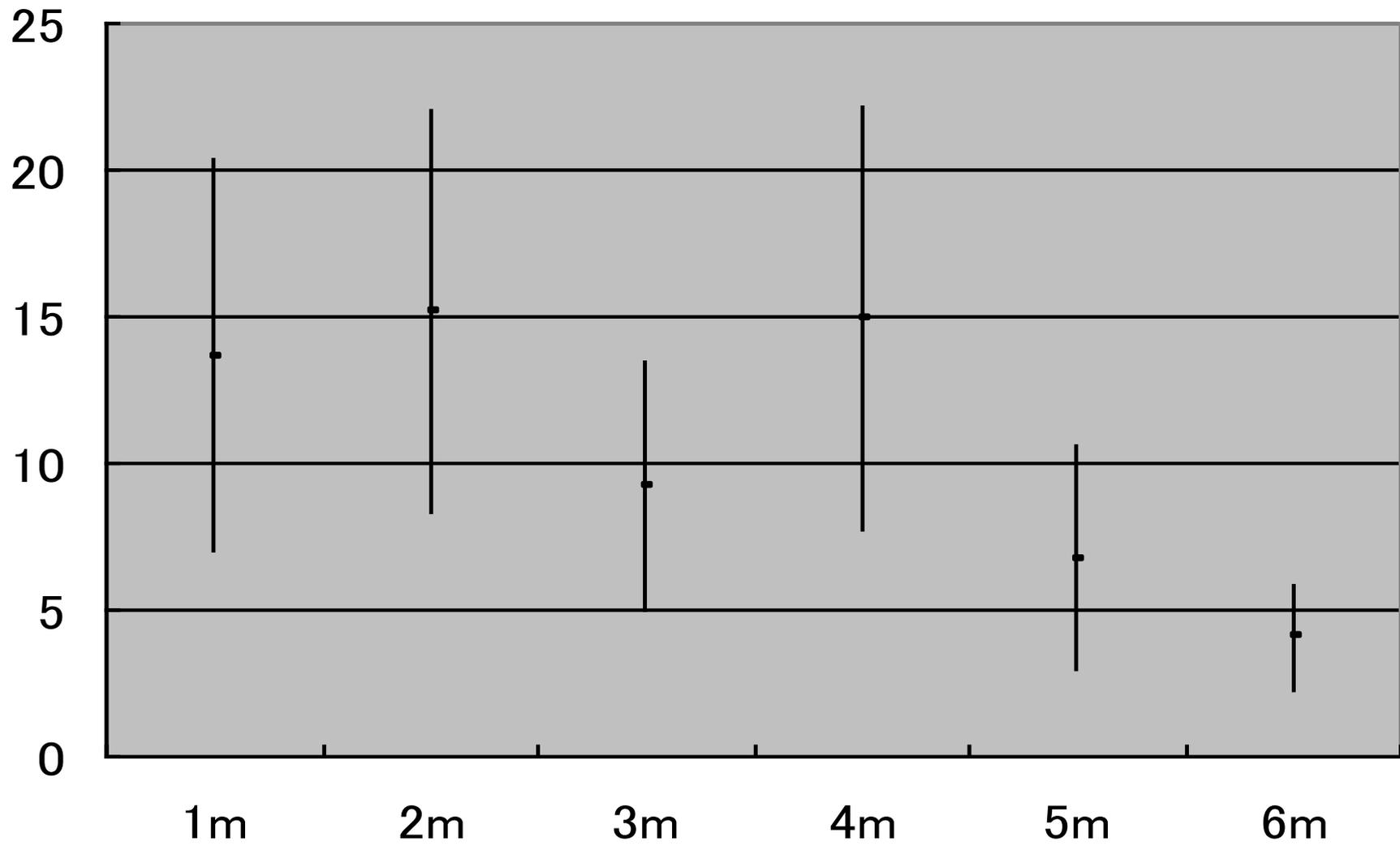
5m

6m

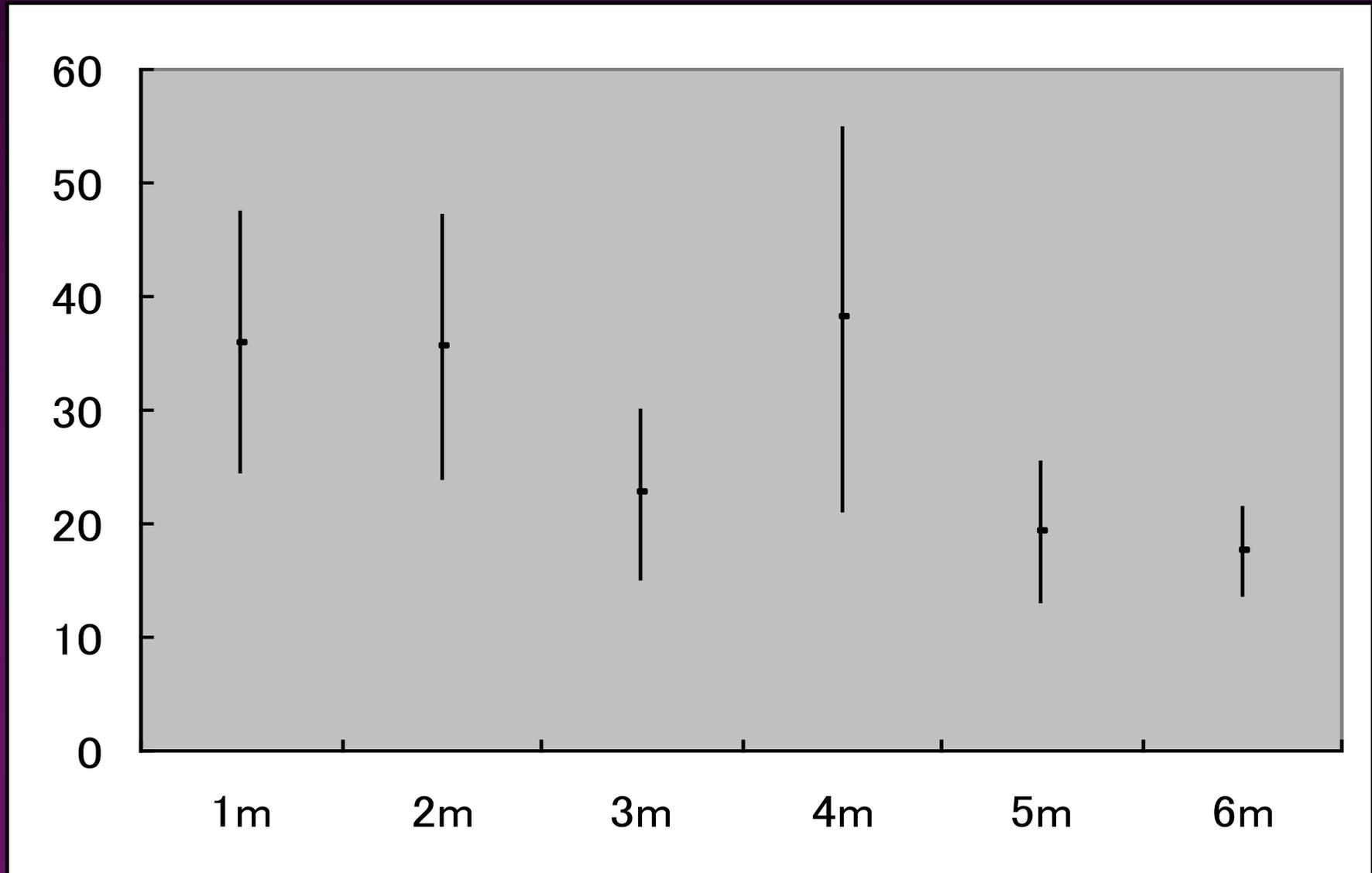
# 骨密度



# 骨塩量



# 骨面積



# *The disadvantage of omental flap*

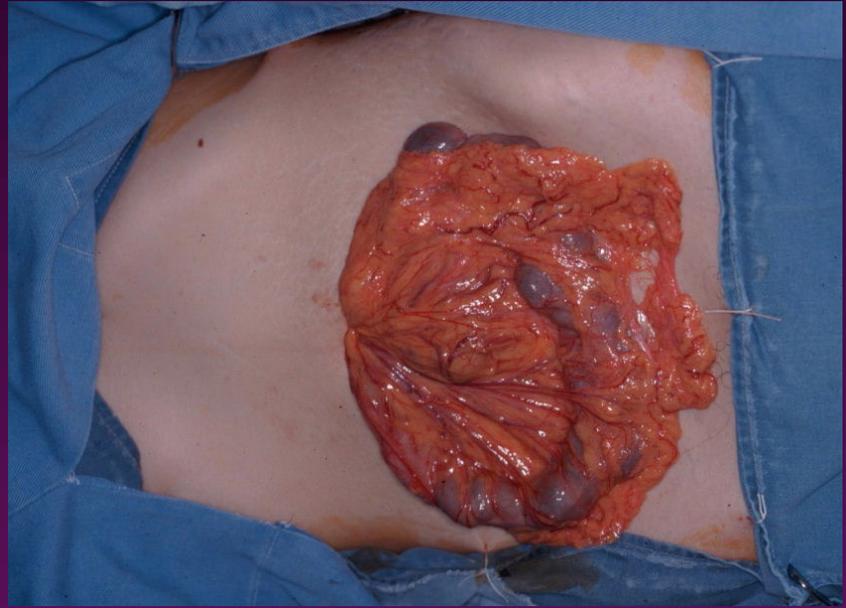
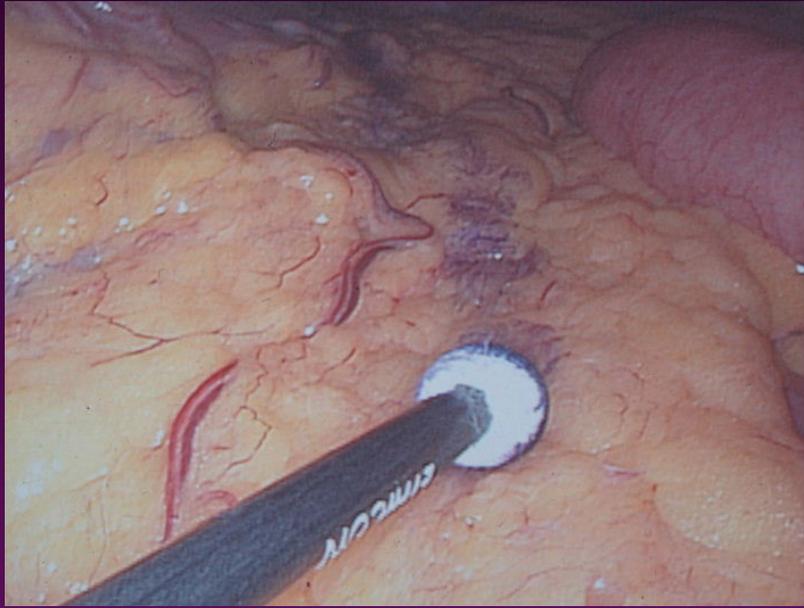
開腹が必要

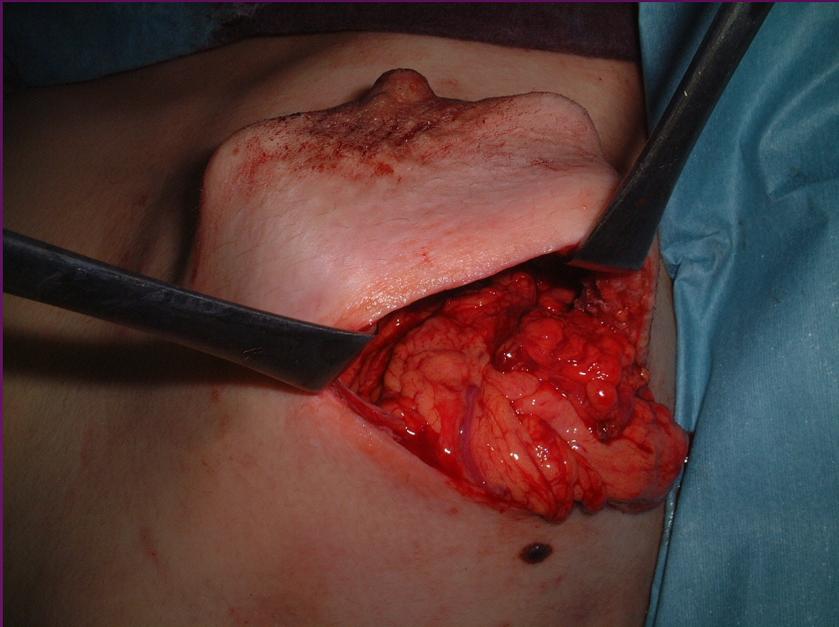
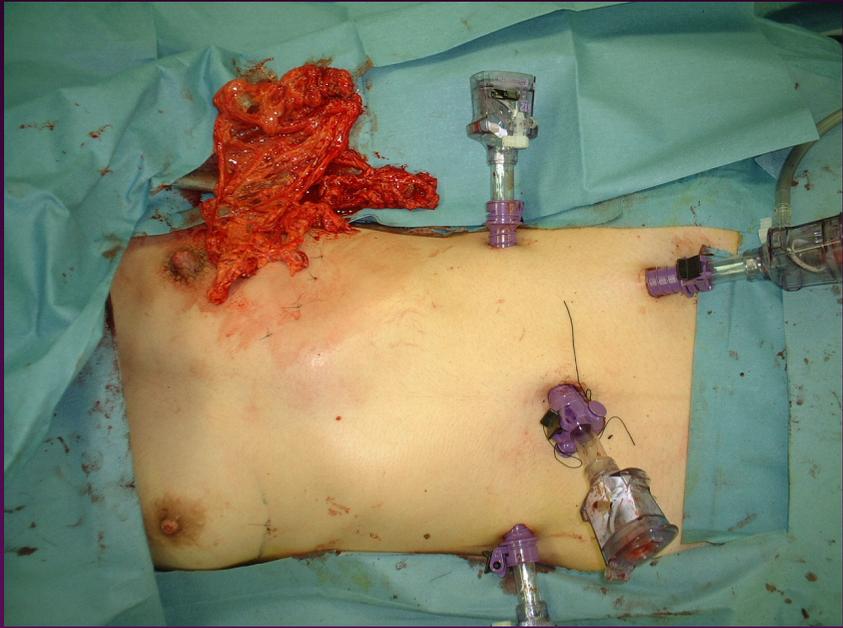


腹腔鏡下採取

*Using laparoscopy to harvest omentum should decrease the incidence of complications.*

*(Kamei Y, Endoscopic omental harvest. Plast Reconstr Surg 102: 2450-3, 1998)*





# 術後6か月

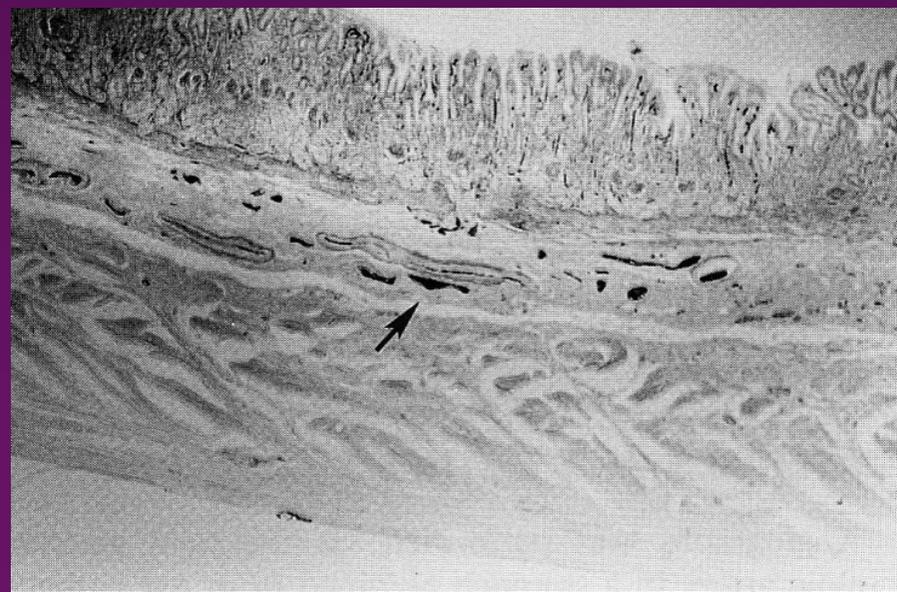
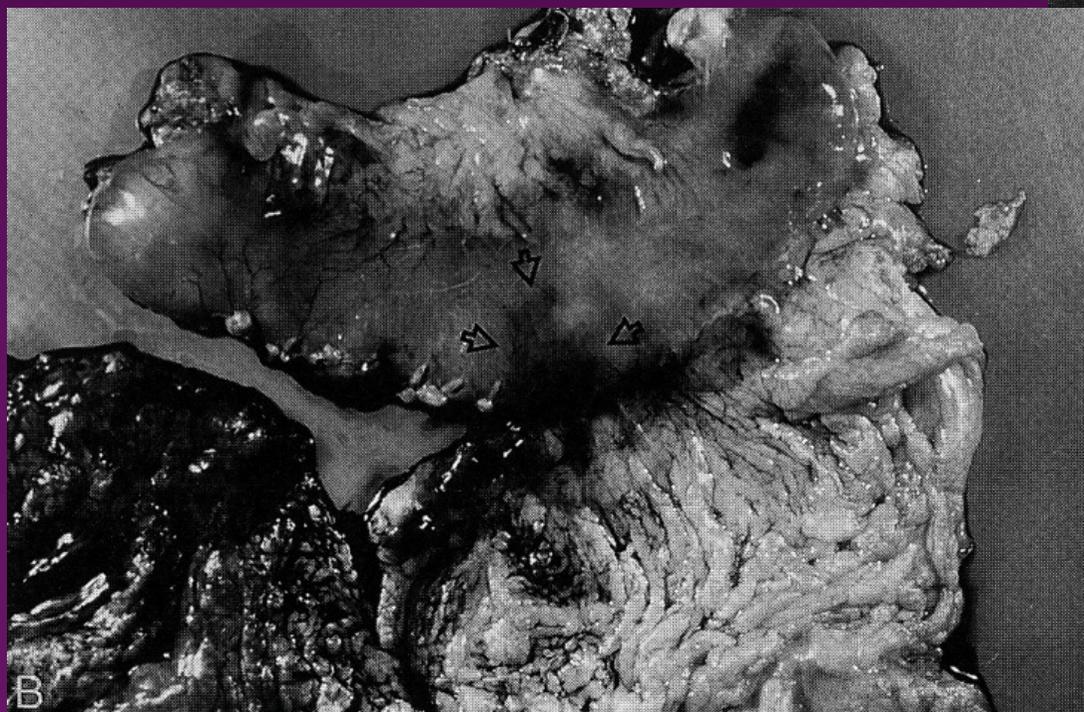
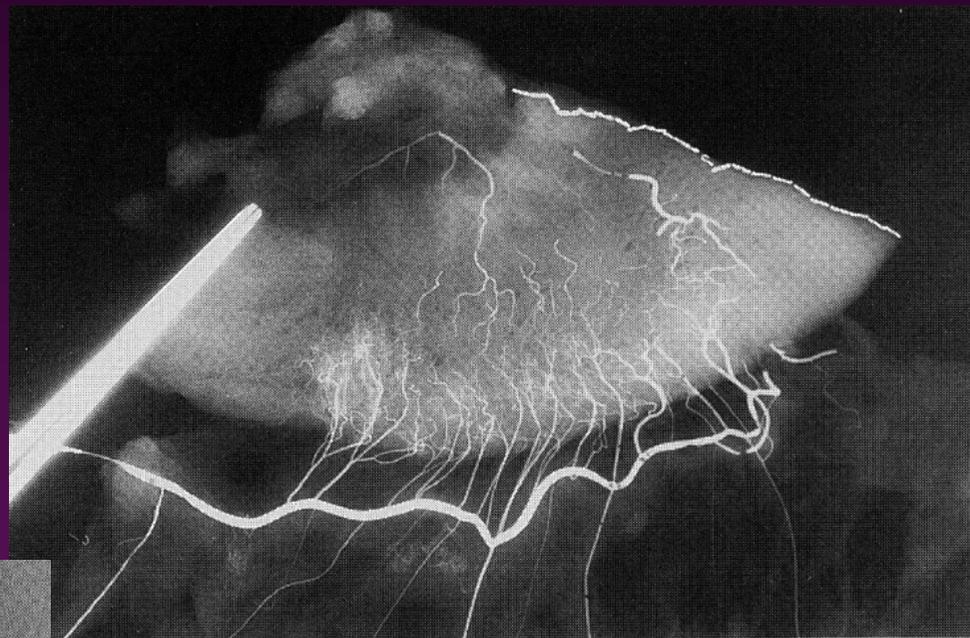








# 大網の応用



*Composite gastric seromuscular and omental flap*  
( *Yuzuru kamei, Ann Surg 220: 97, 1994* )

*Air-tight* あるいは

*Water-tight* が必用な再建 15 例

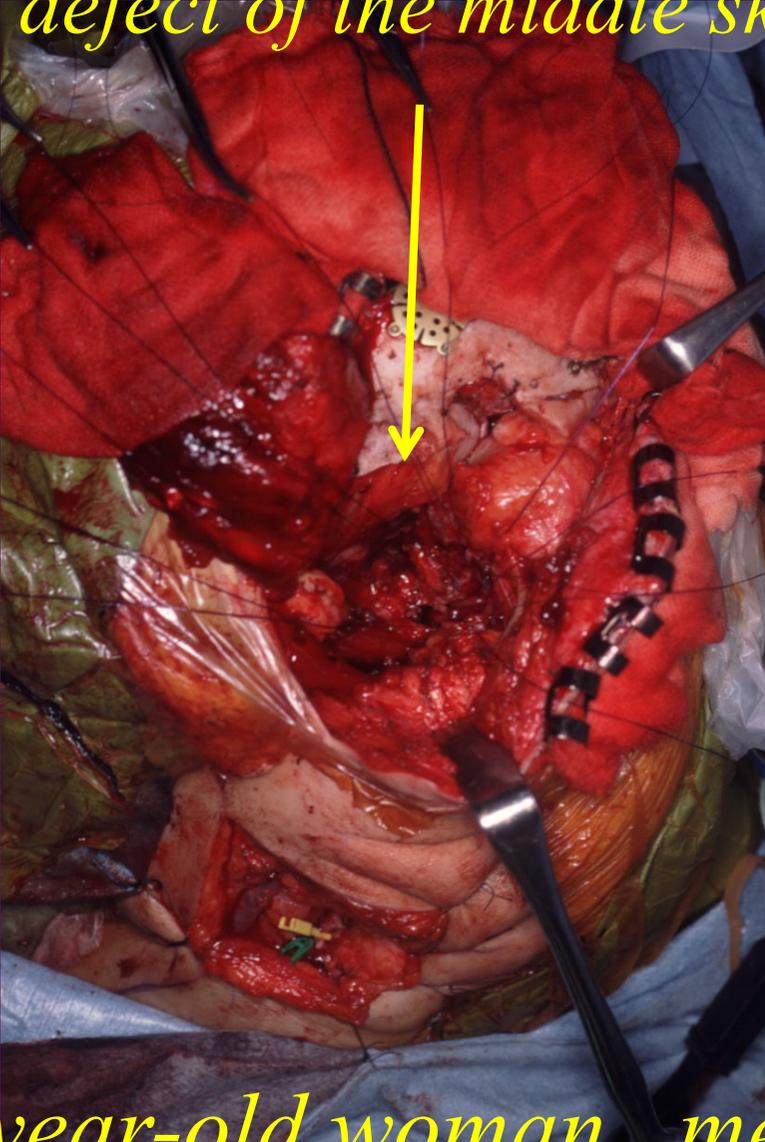
→ 全例良好



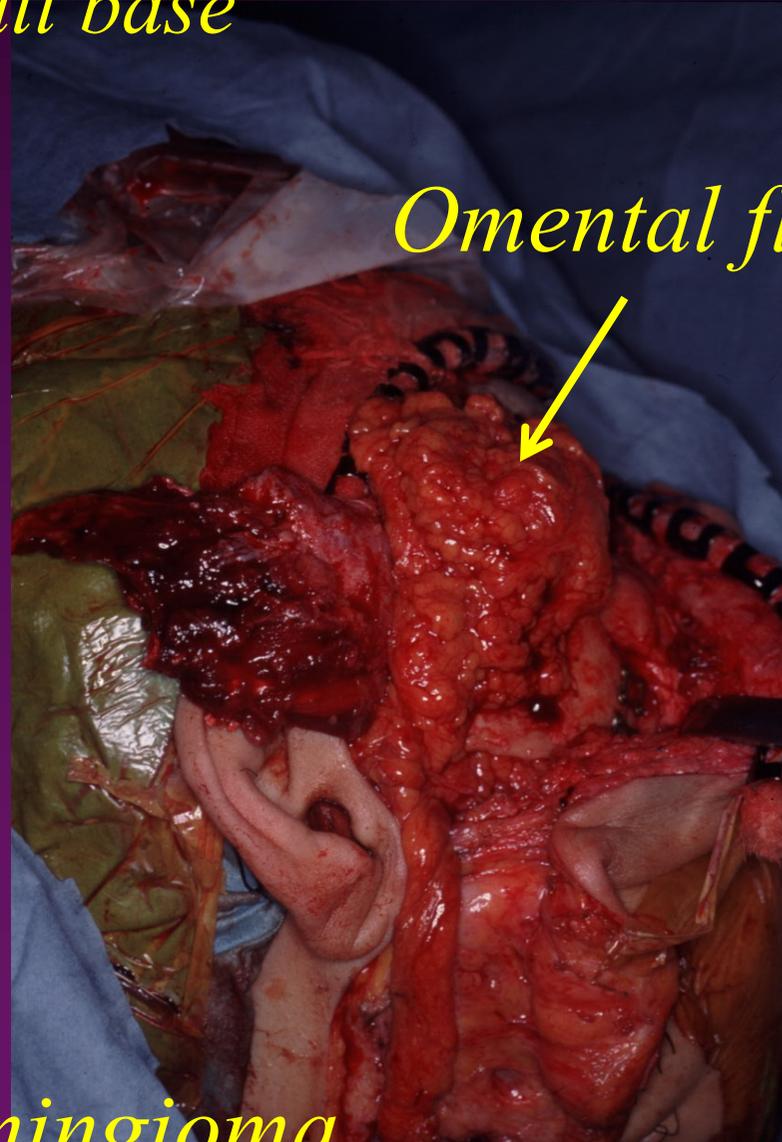
*Combination gastric seromuscular patch and omental pedicle flap for bronchial fistula.*  
Kamei Y, *Ann Thorac Surg* 1993

*Composite gastric seromuscular and omental pedicle flap for urethral and scrotal reconstruction after Fournier's gangrene.* Kamei Y, *A Ann Plast Surg* 1994

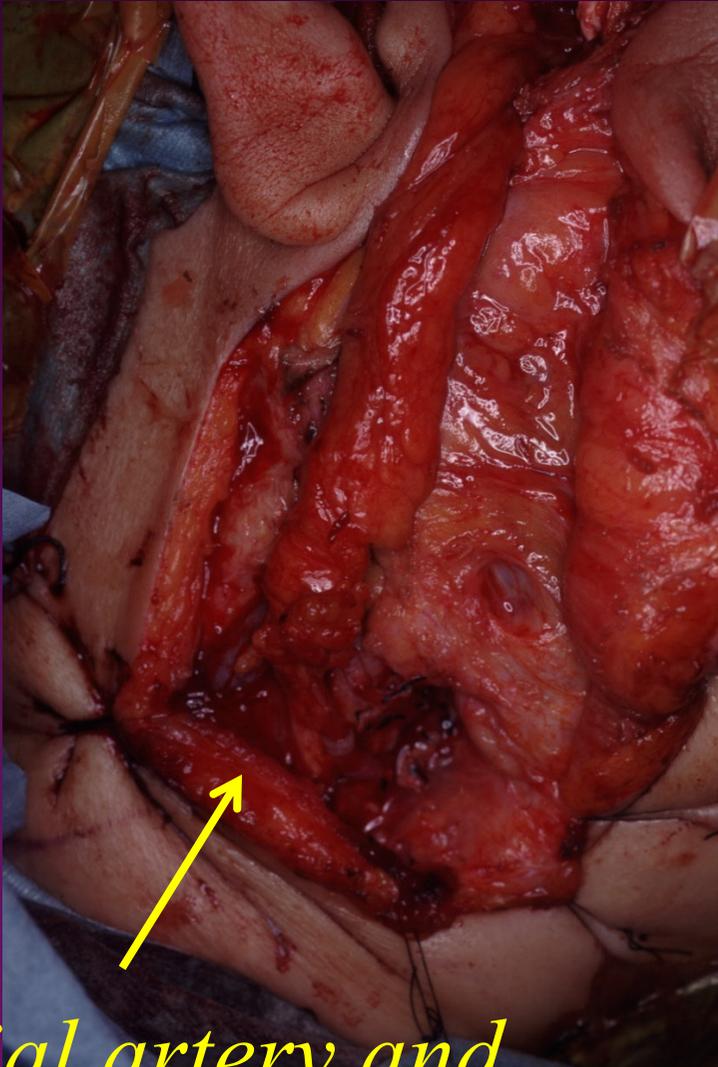
*The defect of the middle skull base*



*Omental flap*



*58-year-old woman, meningioma*



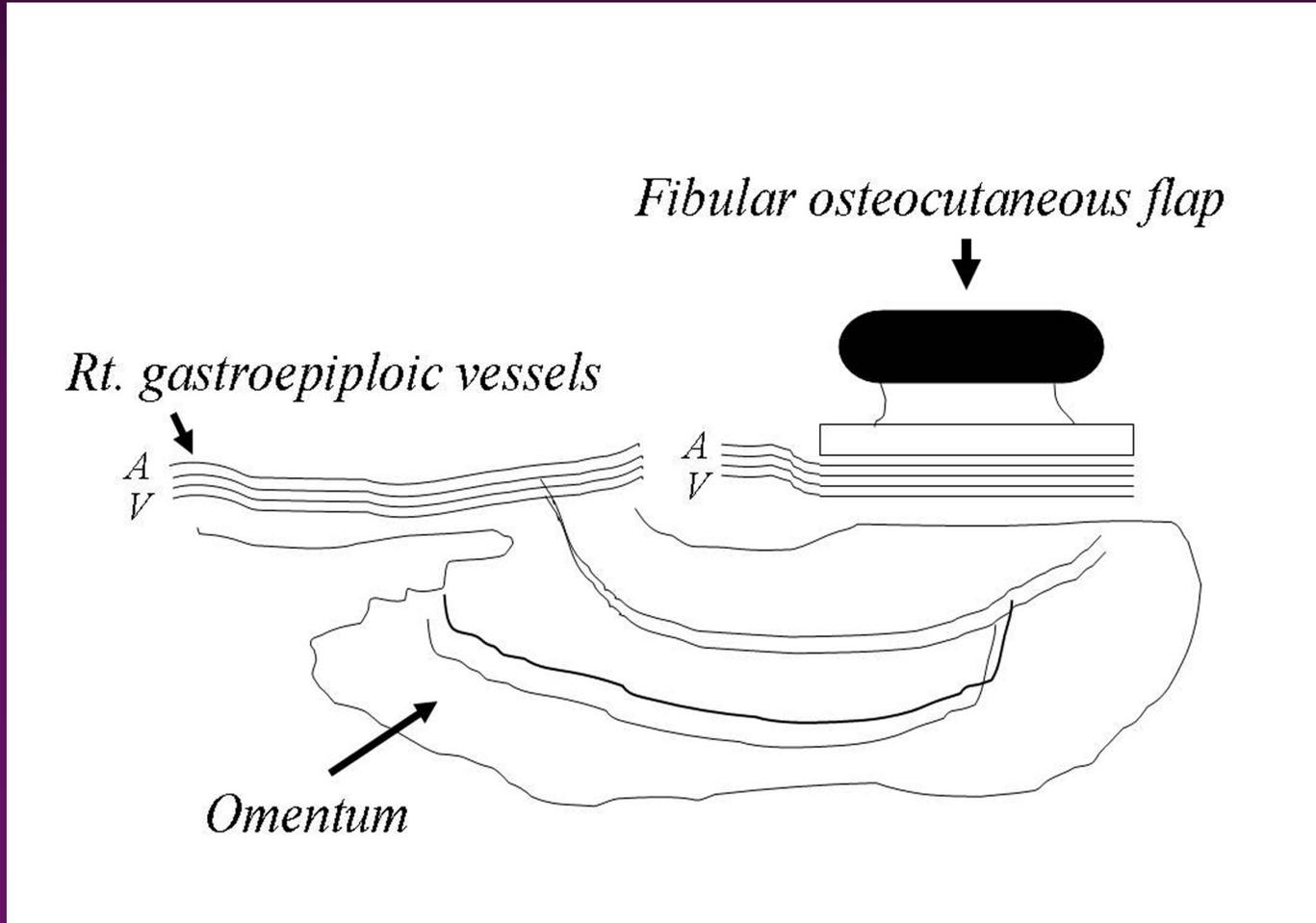
*Facial artery and  
ex. Jugular vein*



*Postoperative view  
Two years after surgery*

# Use of omental flaps as bridge flaps

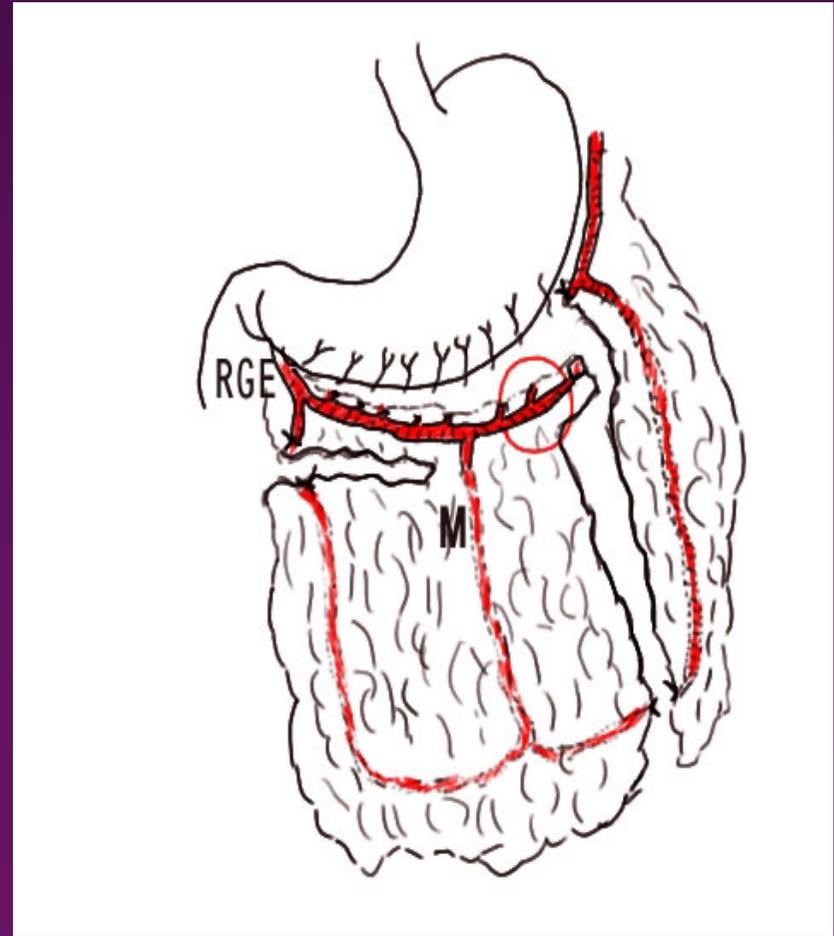
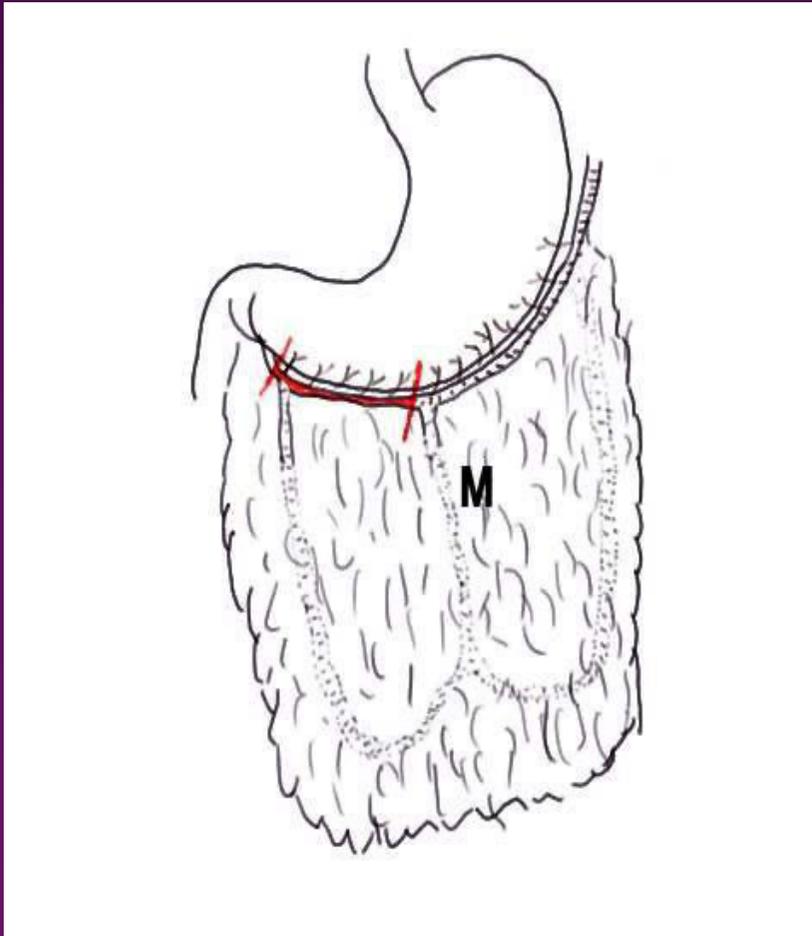
29例

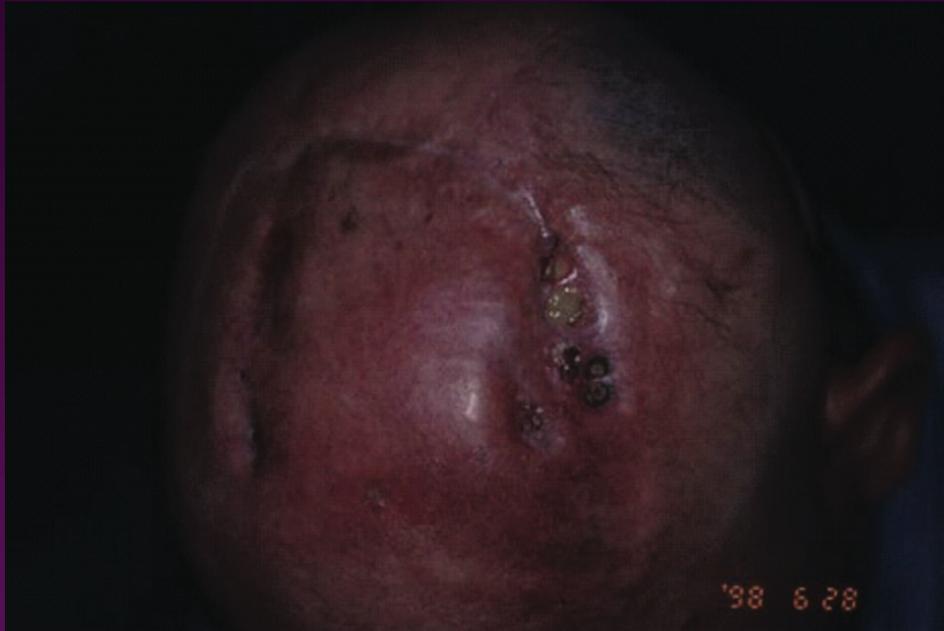


# *The use of omental flaps as bridge flap*

*bridge flaps*

29例

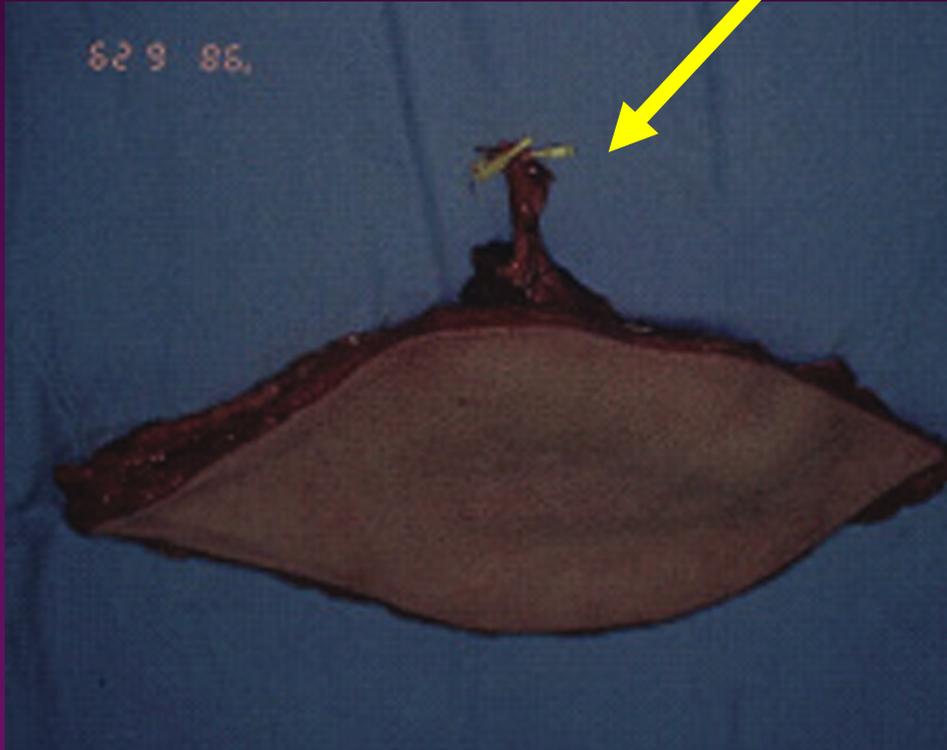




*A 49-year-old man  
with osteomyelitis of  
skull bone*



*The descending branch of lateral circumflex femoral vessels*



*Antelolateral thigh flap*

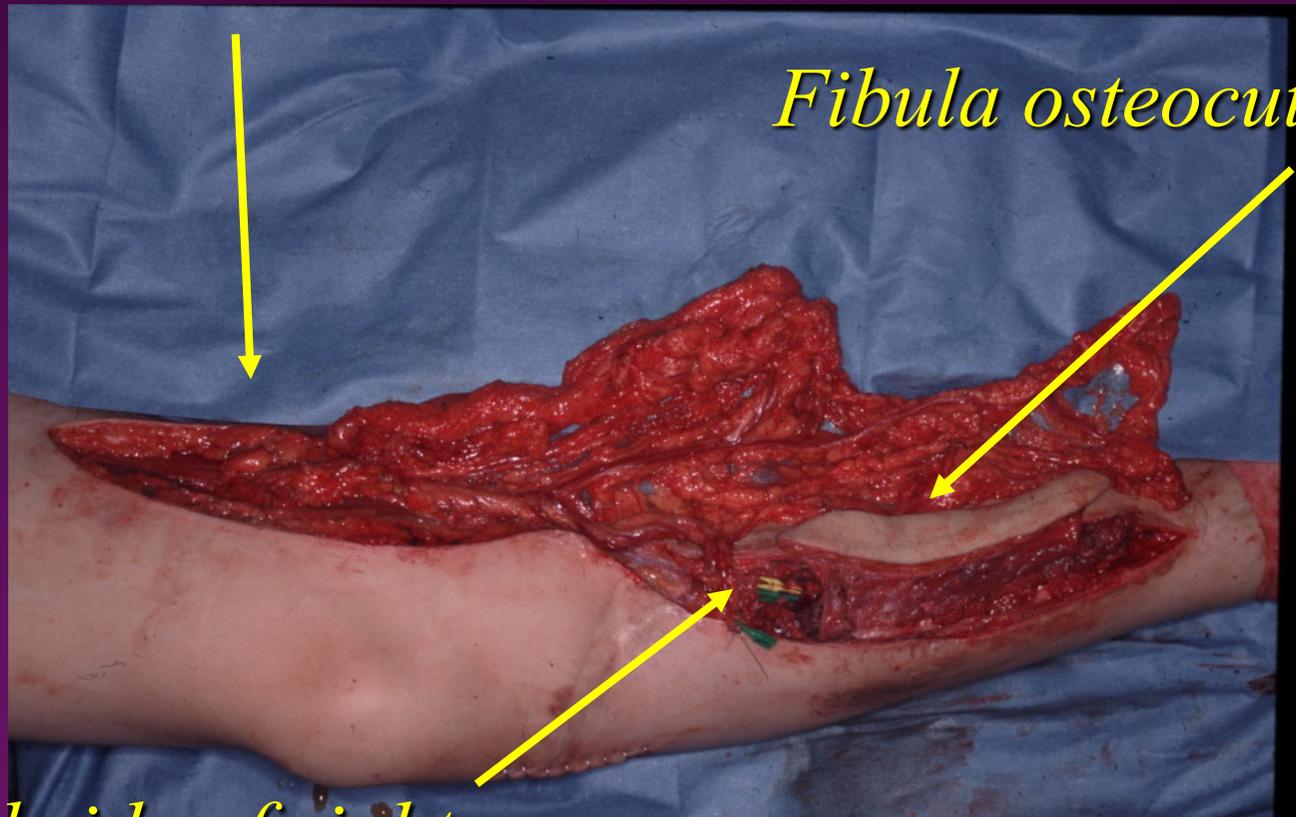


*There have been no complication during 8 years of follow-up.*

*A 28-year-old man with pseudoarthrosis*



*The descending genicular artery  
and greater saphenous vein*



*Fibula osteocutaneous flap*

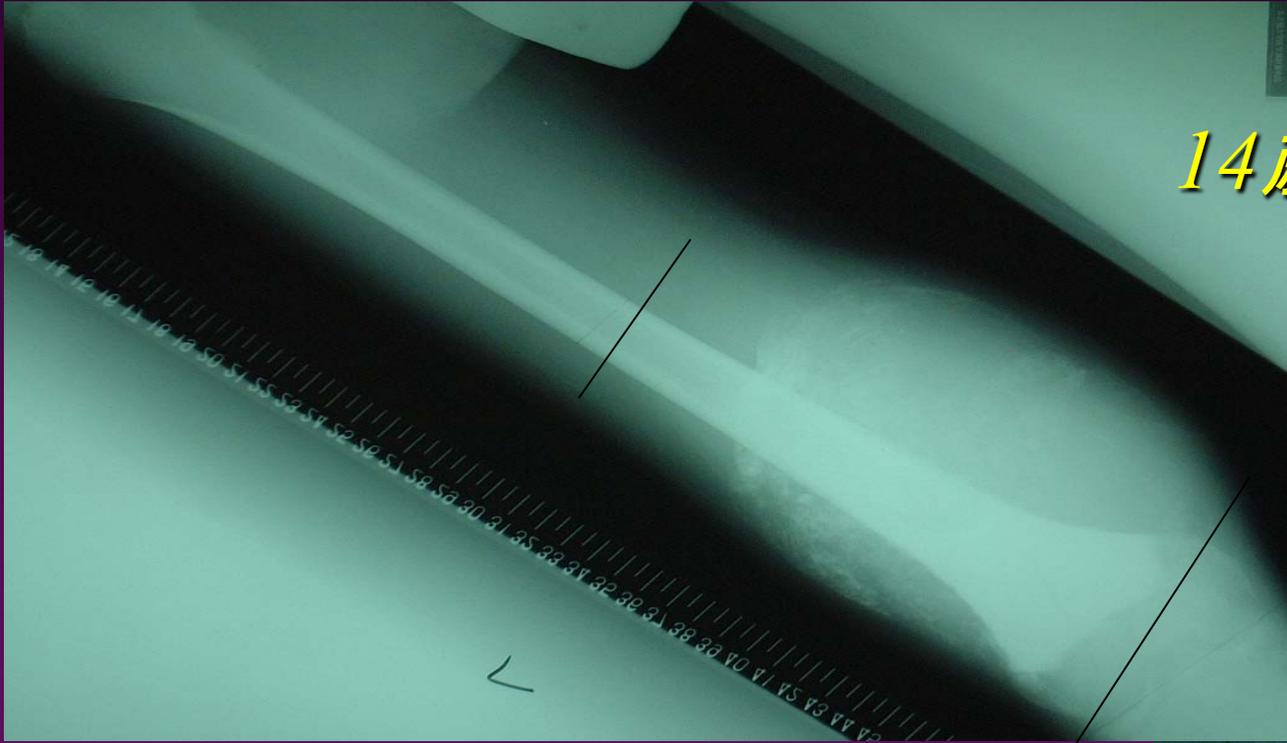
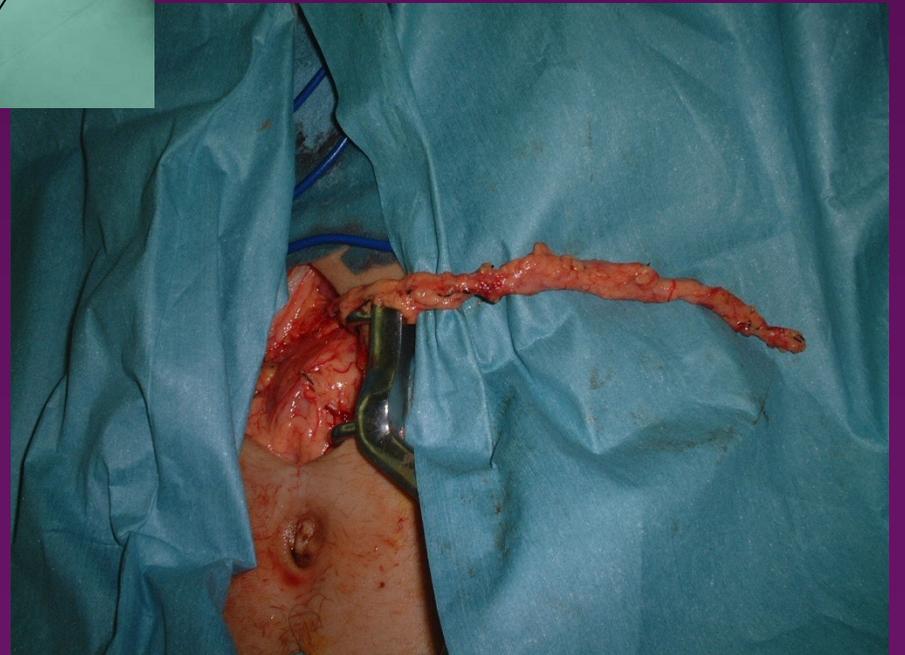
*The distal side of right  
gastroepiploic vessels*

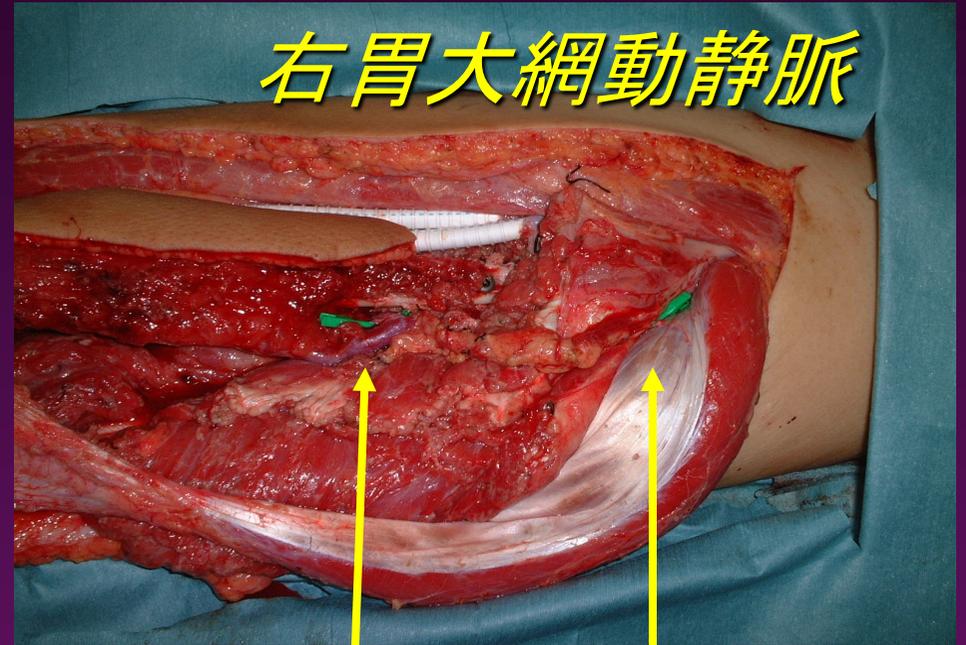
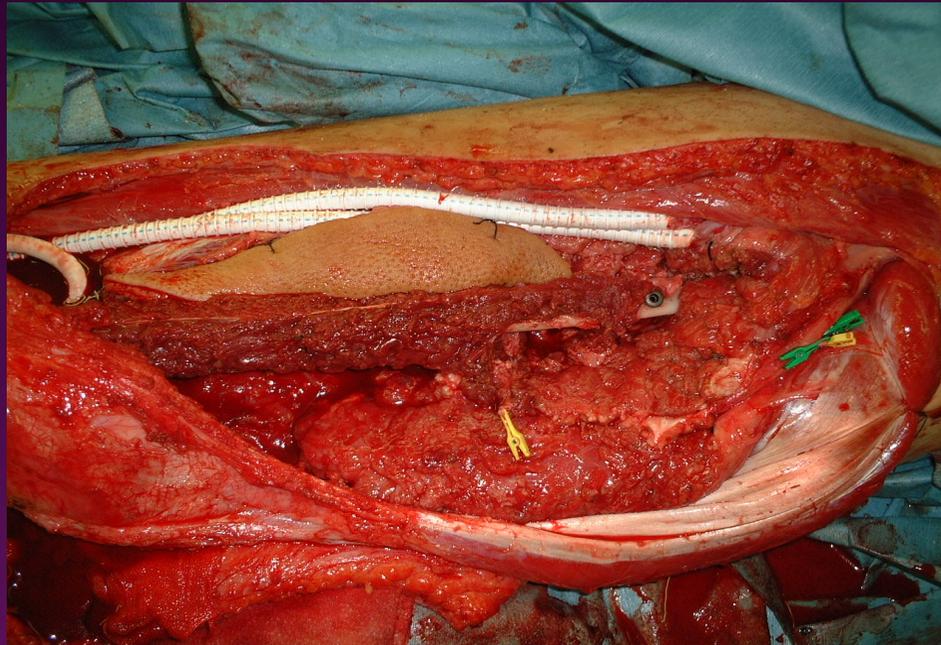


14歳 左大腿骨骨肉腫

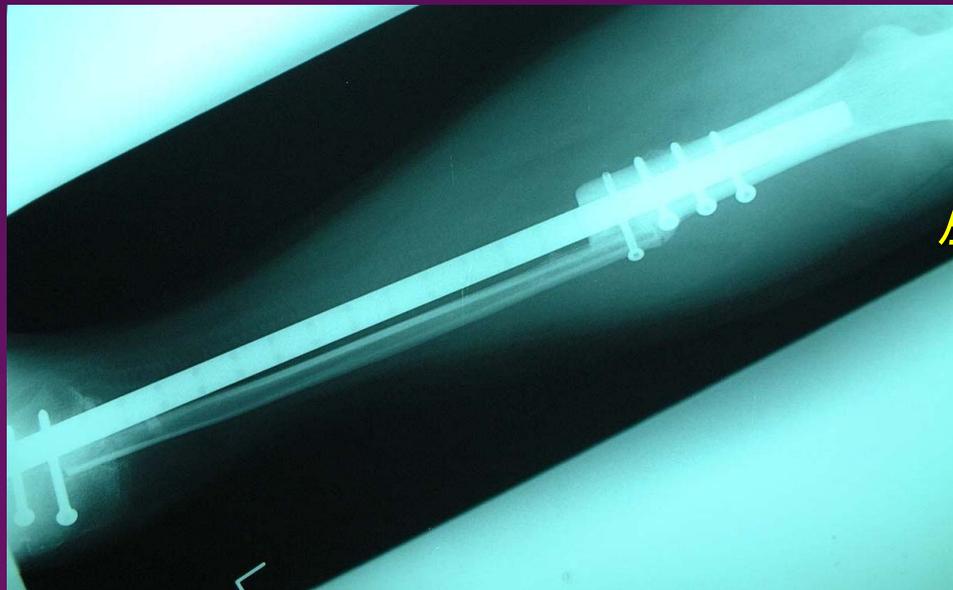
髓内釘と腓骨による再建

大網を血管茎のみとして利用





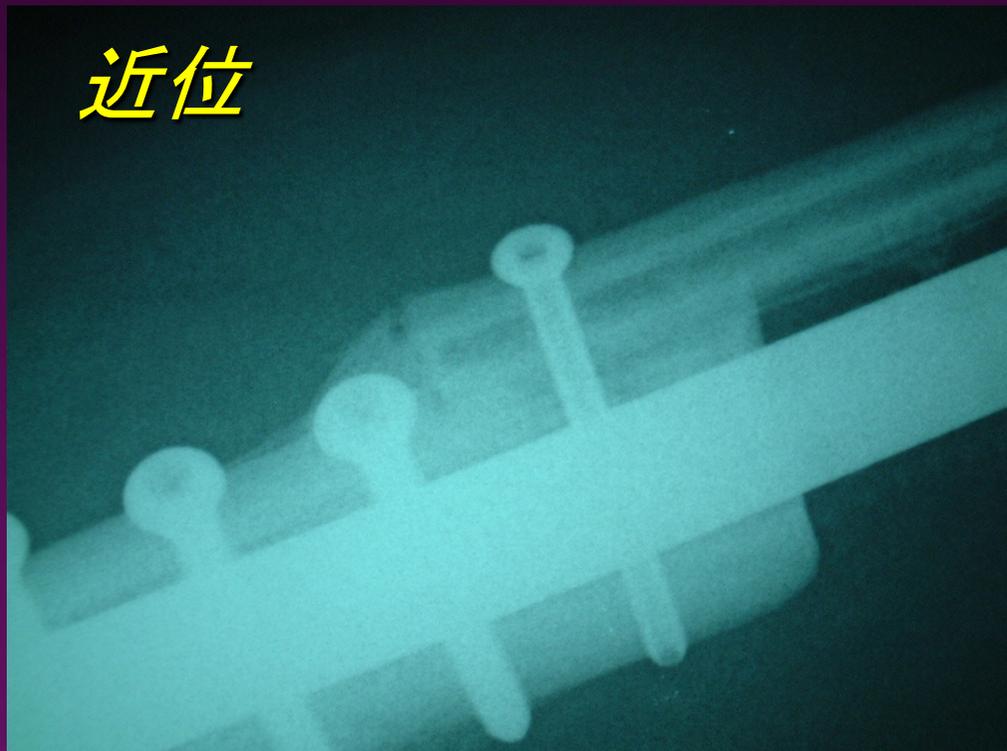
右胃大網動静脈



腓骨動静脈との吻合

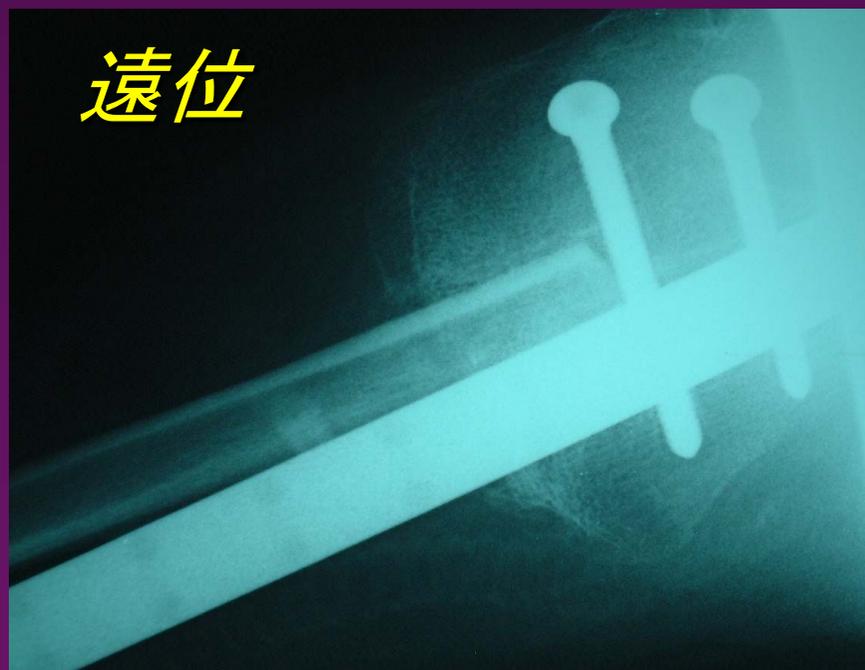
外側大腿回旋動静脈上行枝に吻合

近位



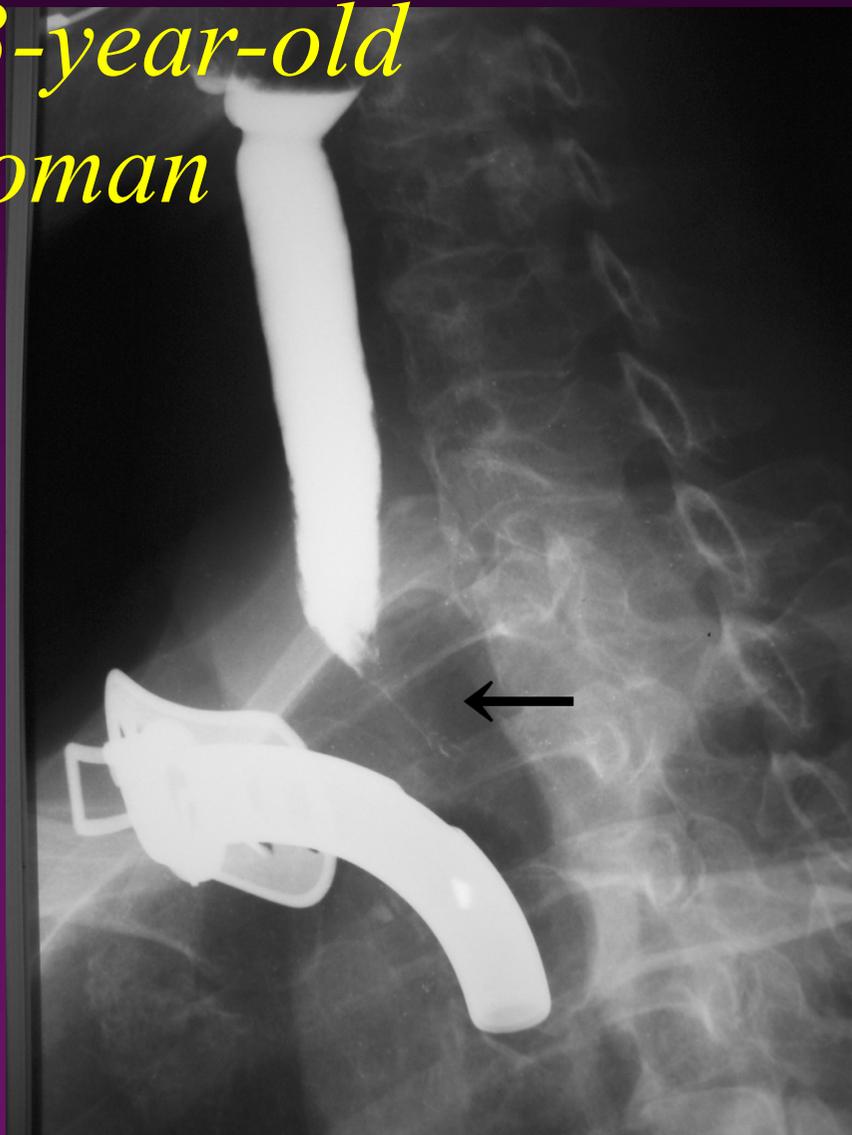
術後6ヶ月

遠位

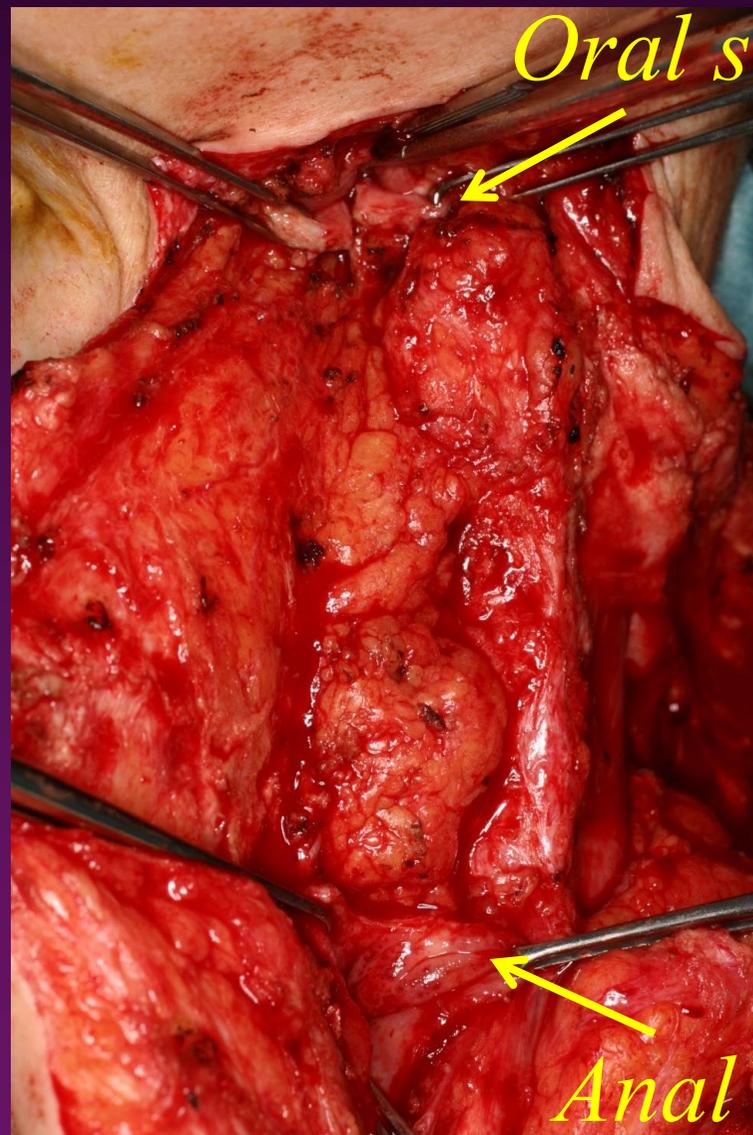


LLB付け両松葉杖にて  
歩行、退院

*73-year-old woman*



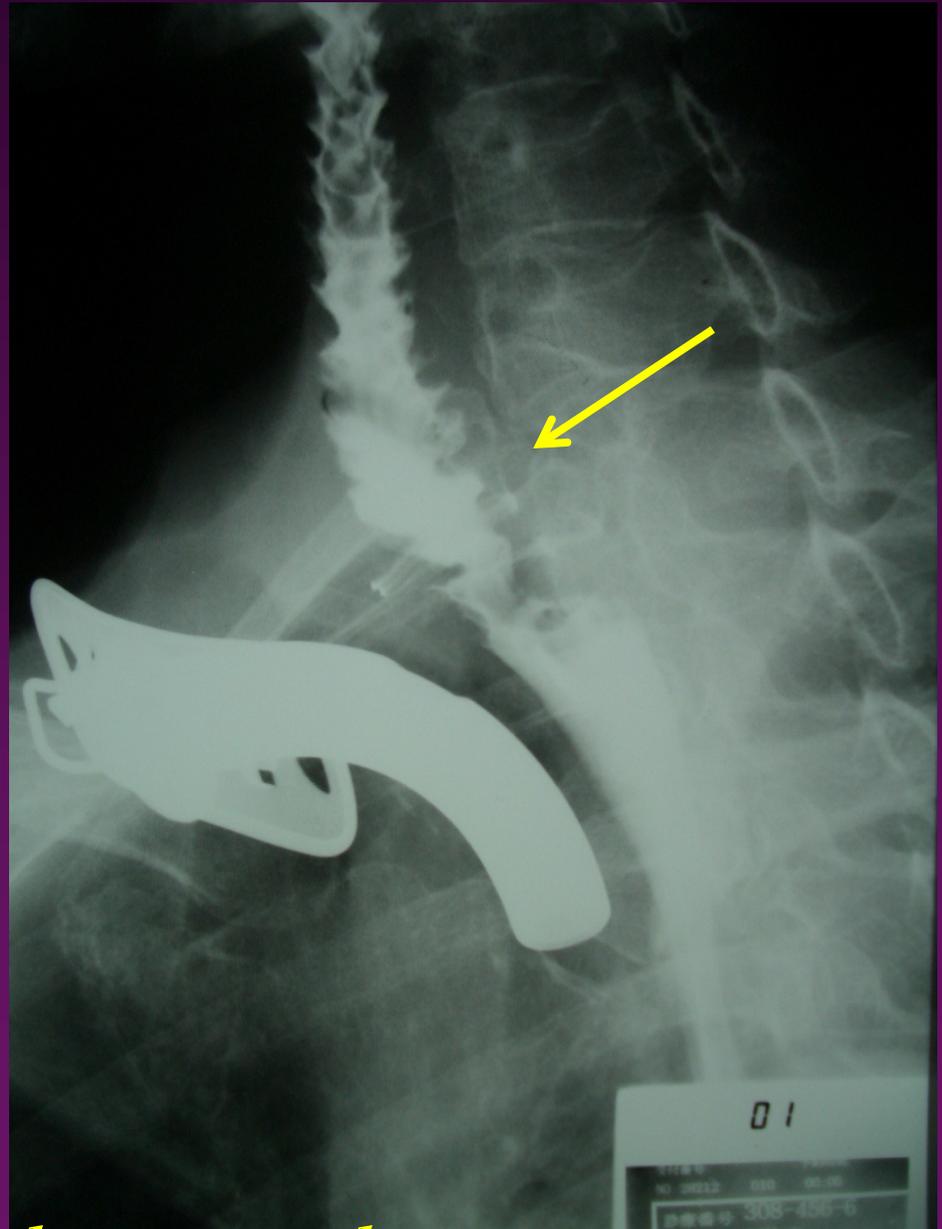
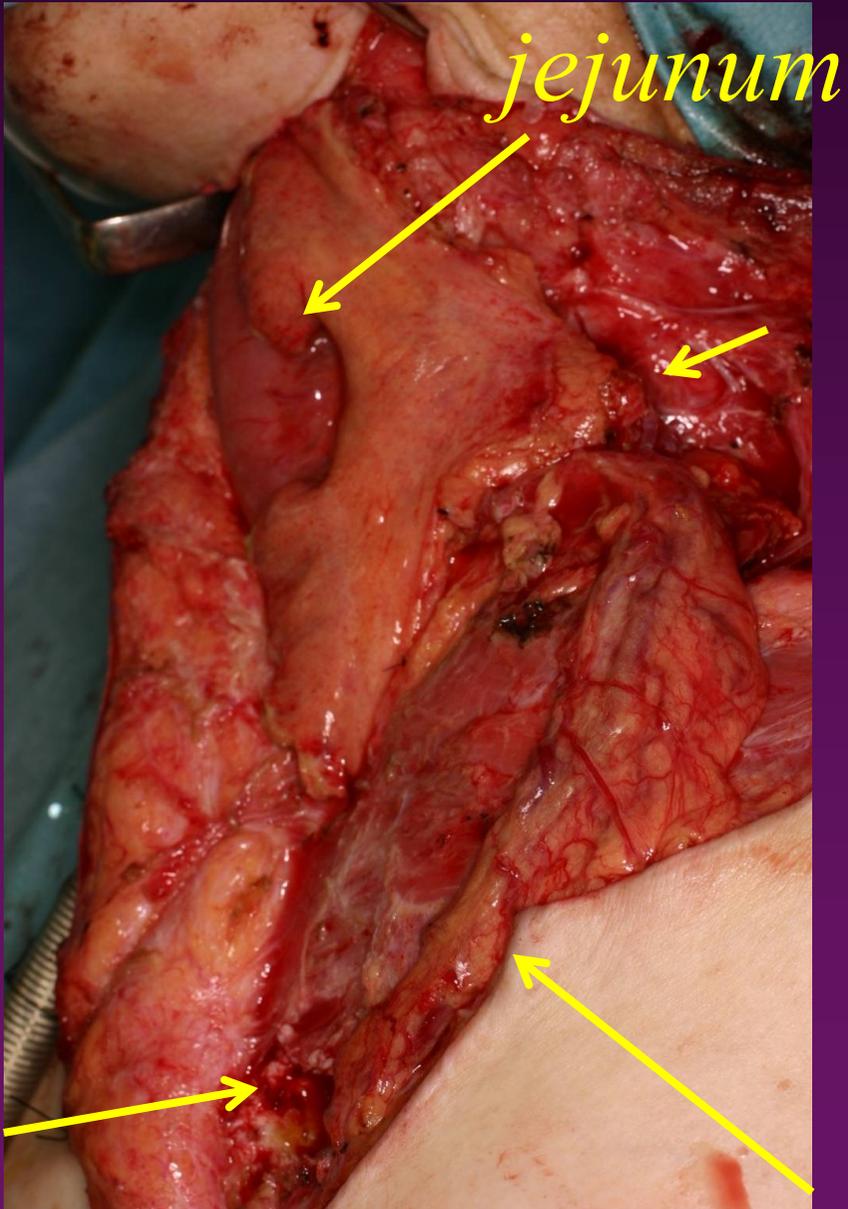
*The stenosis of esophagus*



*Oral side*

*Anal side*

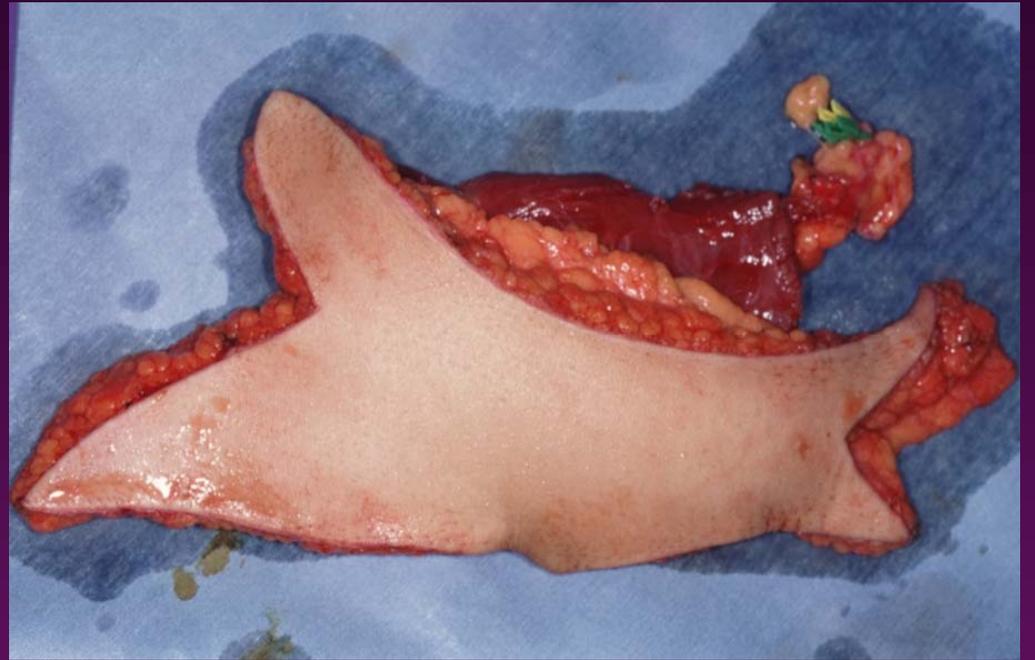
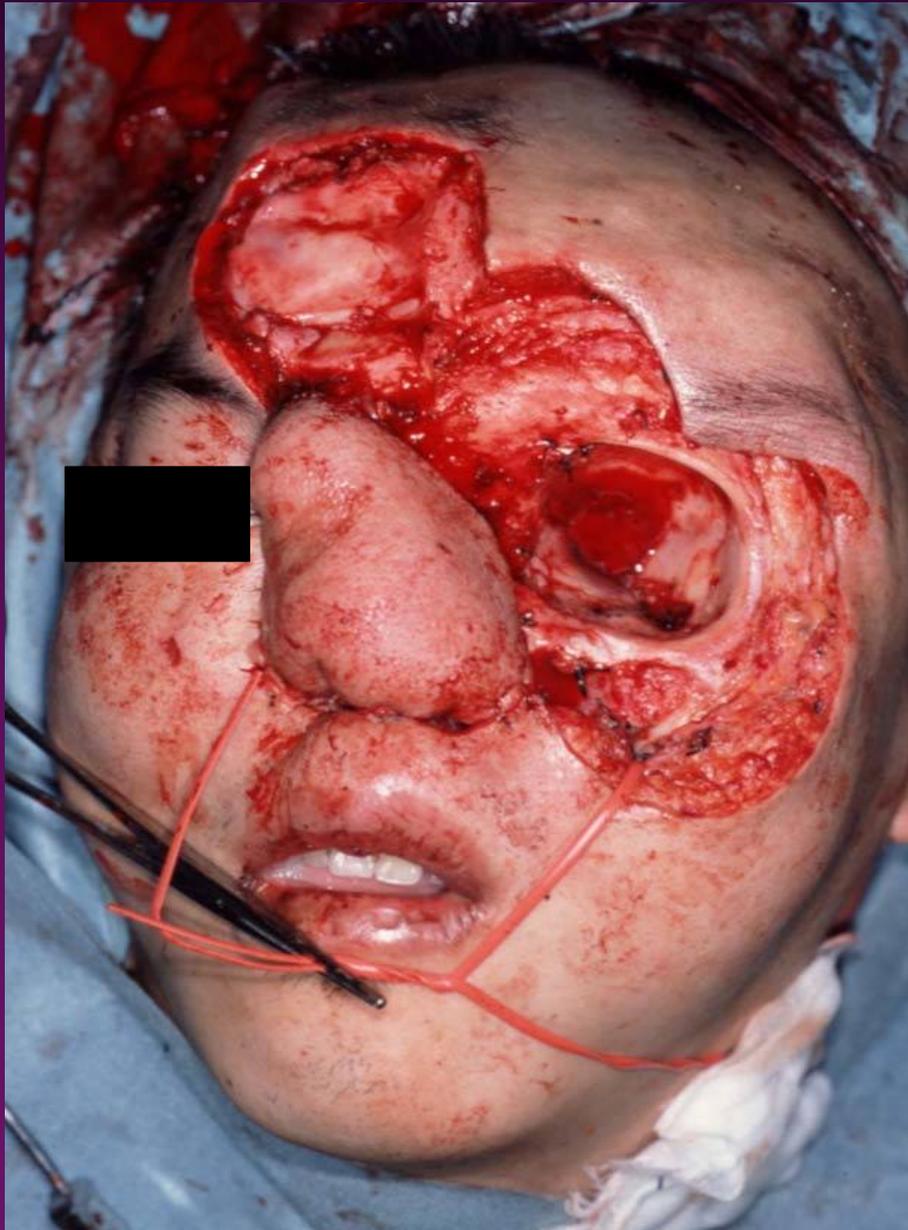
*The defect of esophagus*



*Rt. Gastroepiploic vessels*

30歲男性

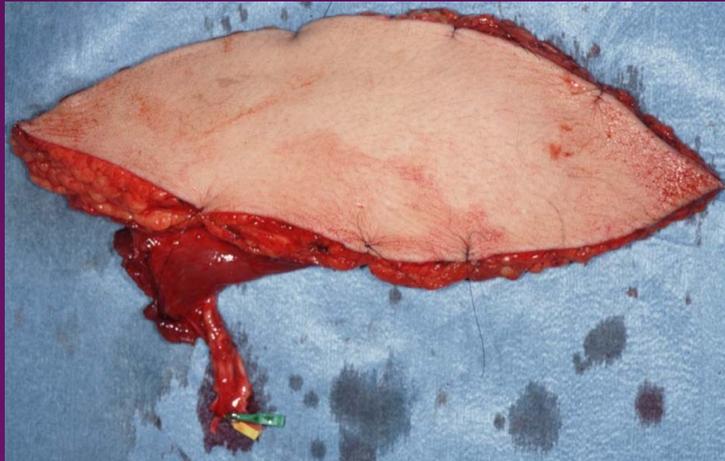
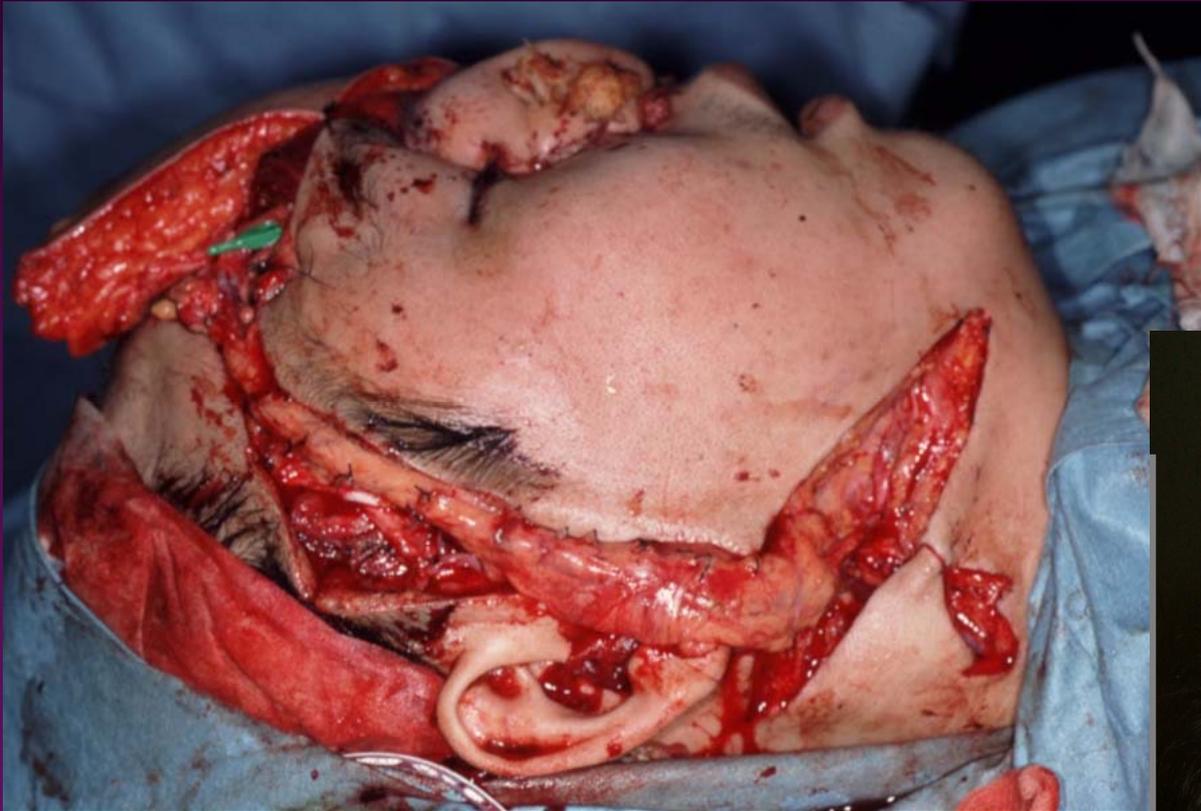




遊離腹直筋皮弁

鼻は *median forehead flap*

# 大網+ALT



# *Use of omental flaps as bridge flaps*

## *The second flaps*

<i>Fibula osteocutaneous flap</i>	<i>16</i>
<i>Jejunum</i>	<i>6</i>
<i>Anterolateral thigh flap</i>	<i>2</i>
<i>Iliac bone</i>	<i>2</i>
<i>Radial forearm flap</i>	<i>2</i>
<i>Latissimus dorsi muscle</i>	<i>1</i>

# *The use of omental flaps as bridge flap*

*静脈血栓 (the distal flap) 1例*

*external venous shunt により救済*

*他 28例 は良好*

# 大網とマイクロサージャリー

## 【役職】

日本マイクロサージャリー学会理事長

日本頭蓋顎顔面外科学会理事長

日本形成外科学会副理事長

日本創傷外科学会副理事長

日本手外科学会副理事長

日本頭蓋底外科学会理事

日本形成外科手術手技学会常務理事

## 【開催全国学会】

日本形成外科学会学会総会学術集会

日本マイクロサージャリー学会

日本頭蓋底外科学会

日本創傷外科学会

日本形成外科手術手技学会

*Thank you for your attention.*

