

The rat ischemic epigastric skin
flap model revisited:
Optimization of flap dimension
and ischemic duration

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Affiliations and Disclosures

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- **Nothing to disclose**

Introduction

- The superficial inferior epigastric artery (**SIEA**) originates from the femoral artery, and gives into medial and lateral branches to supply the epigastric skin flap model.
- The **non-standardization** of many parameters, such as flap dimension, borders, vascular supply, and ischemia duration, makes the model sub-optimal.

The non-standardization of the model

Study Name	Rat Species & Weight(g)	Borders	Flap Dimension (cm)	Clamped vessel	Duration (hr)	Control Necrosis Area(%)
Küntscher MV et al. PRS(2002)	Wistar; 230-335	Undefined	6*10	Artery & Vein	3	68.2
Reichenberger MA et al. Injury (2012)	Lewis; 250-300	Undefined	6*10	Artery& Vein	3	66.7
Gideroglu K et al. J Surg Res(2009)	SD;200-235	Undefined	4*5	Artery& Vein	12	41.4
Çetl'n C et al. Ann Plast Surg(2001)	SD;250-300	Undefined	3*6	Artery	10	56
Kuo et al. J Surg Res (2002)	Lewis;250-300	Undefined	7*4	Artery& Vein	12	78
Cetinkale O et al. PRS(1998)	Wistar Albino; 200 in average	Undefined	3*5	Artery& Vein	11	85.5

Objective

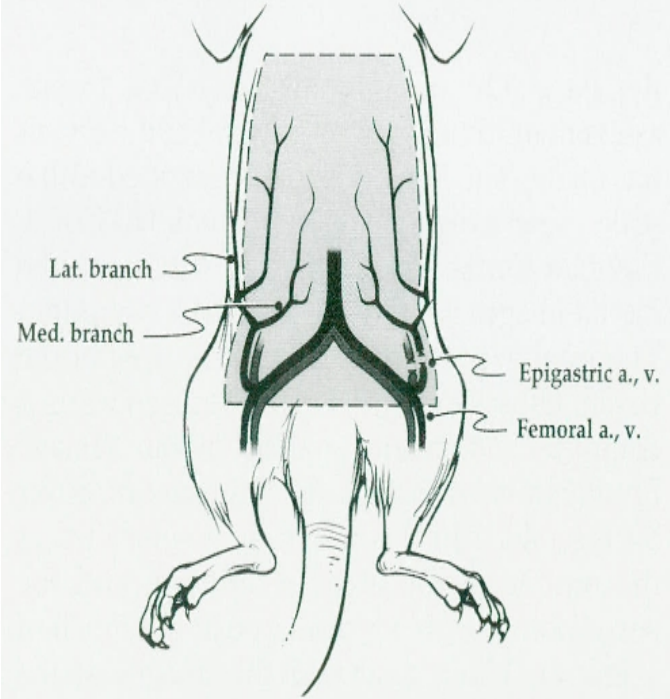
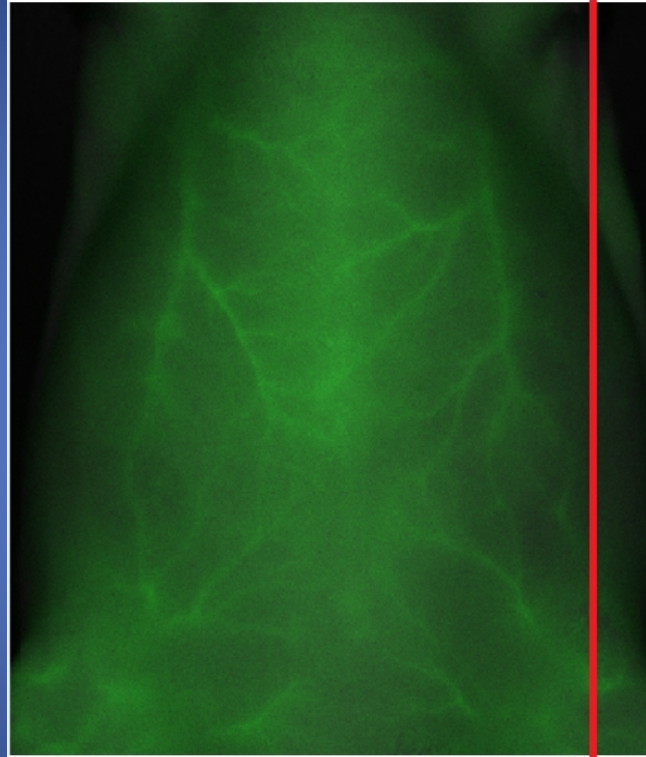
- To build a modified and **standardized model**, specifically designed to evaluate the effects of many different therapeutic modalities towards prolonged ischemia injury, which is frequently encountered in **free tissue transfer**.

Materials and methods

- A novel imaging agent was used pre-operatively in 5 Lewis rats to determine the **optimized borders** of the flap, in order to include the two branches of SIEA.
- Different **arterial ischemia durations** (0, 12, 14, 16, 18 hours) were subsequently induced in five groups (n=5 in each group) after elevation of the flap.

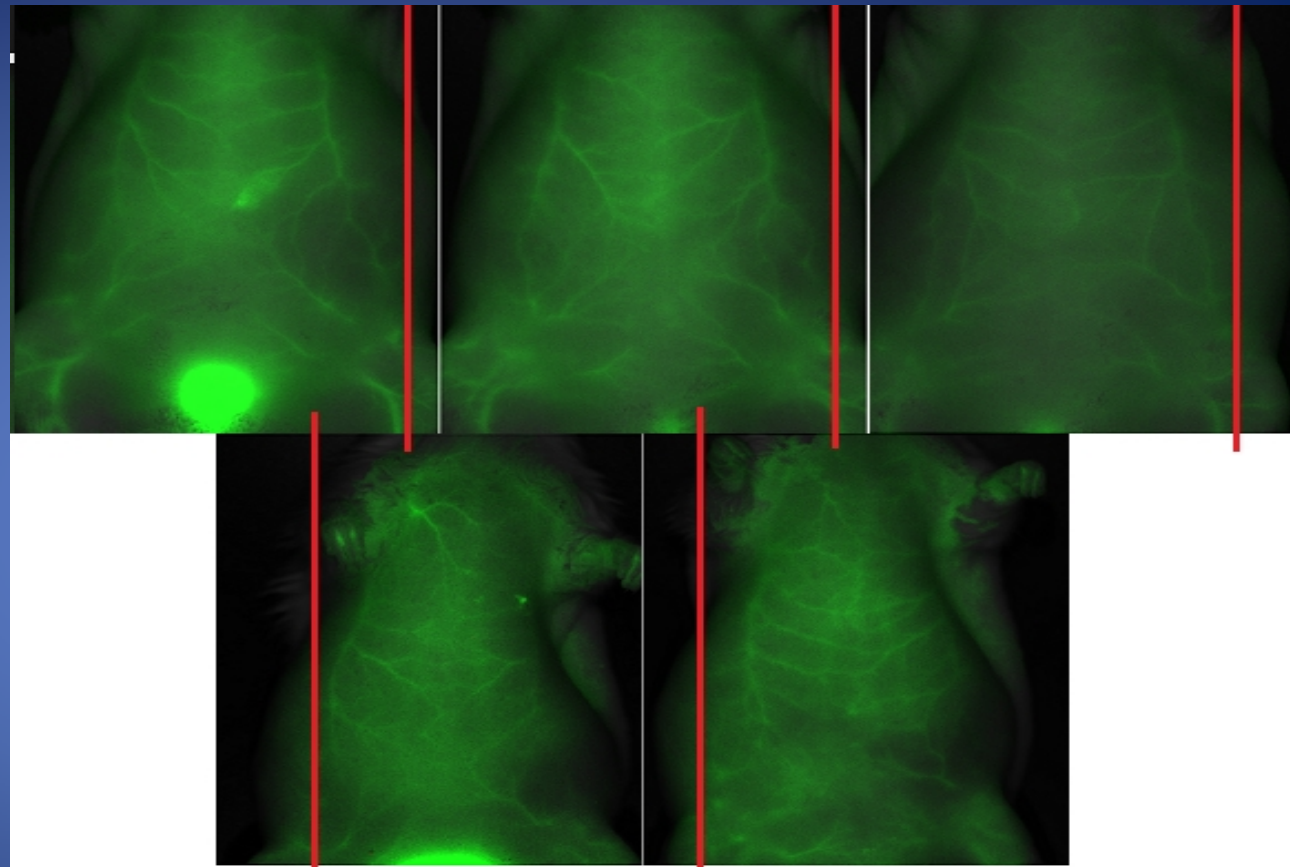
Results

The image study helped to standardize the lateral border of flap, so both branches of SIEA were included.



Lateral axillary line was chosen!

Image study in
five Lewis rats:



The **lateral axillary line** was proved to be the optimized lateral border of the flap.



Superior border:

xyphoid process

Inferior border:

suprapubic line

Lateral border:

lateral-axillary line

Medial border:

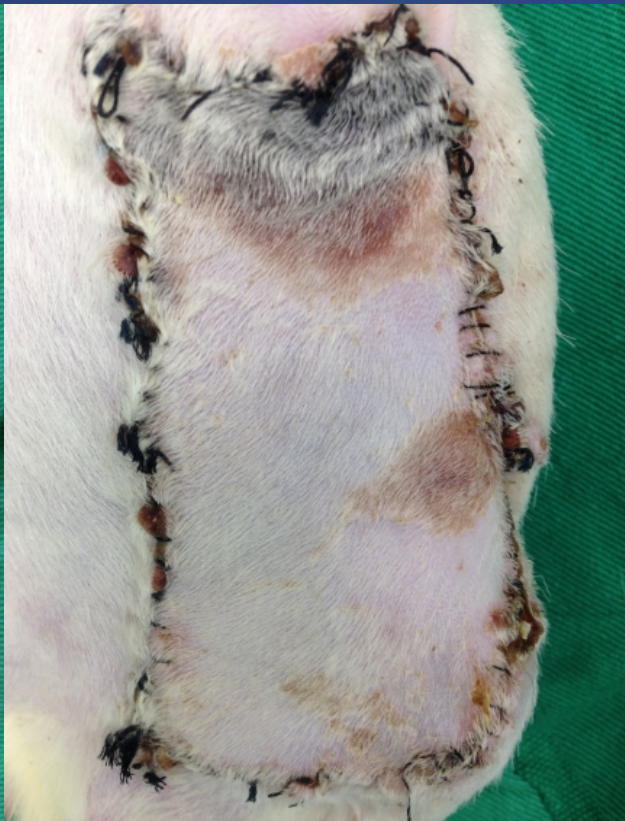
Median line of the
abdomen

- Two vessel clamps were placed on the femoral **artery** only, to specifically simulate the ischemia scenario. Venous occlusion was **not** intentionally generated.
- In group 5(18 hours), **complete loss** of the flap, due to venous thrombosis, was observed in three rats, rendering it unfit for the model.



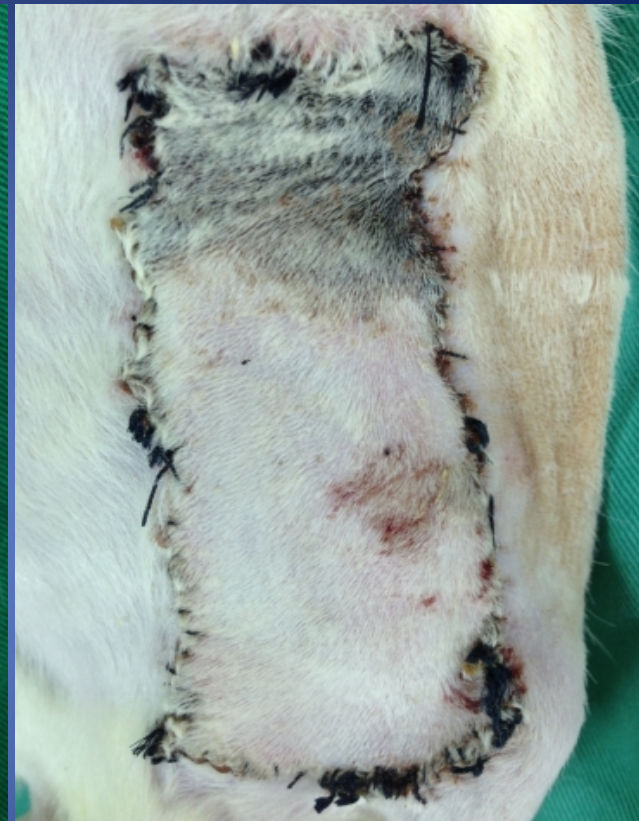
Sham

1.1% necrosis



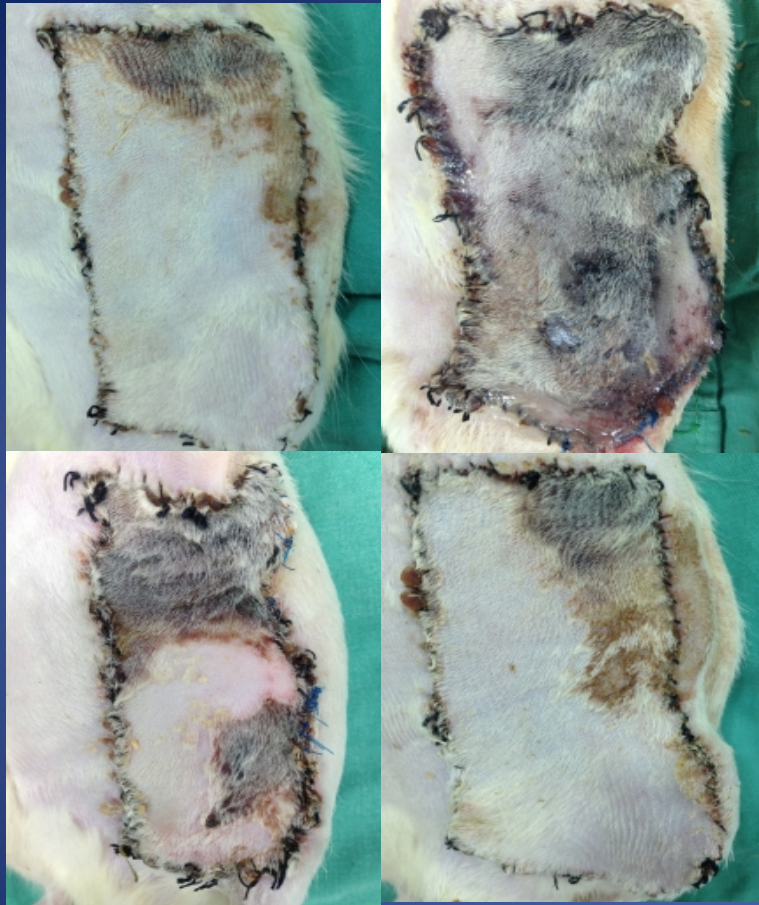
12 hours

26.2% necrosis



14 hours

34.6% necrosis

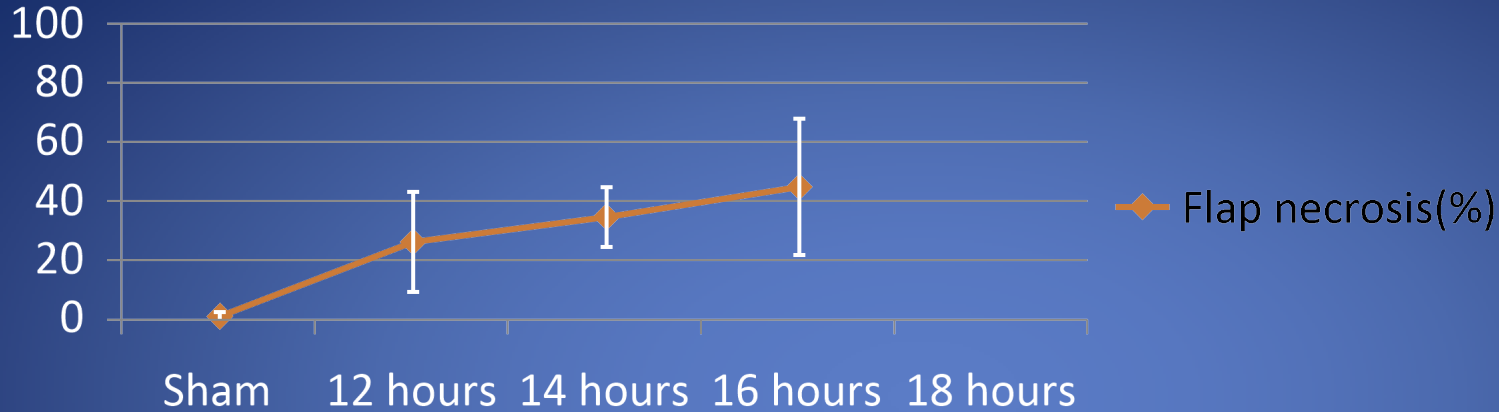


16 hours; **44.8%** necrosis
(highly variable pattern)



18 hours
Complete loss of flap

The flap necrosis area



Ischemia duration	Sham	12 hours	14 hours	16 hours	18 hours
Flap necrosis (%)	1.1±1.31	26.2 ± 16.9	34.6 ± 10.13	44.8± 22.99	Unfit for model

Conclusion

- **14-hours ischemia** was determined to be the most suitable duration for the modified flap model, for it provides **the largest and most consistent** necrosis area to test the effects of different therapeutic modalities.

Significance of the findings

- A modified rat epigastric skin flap model with standardized borders and optimized ischemia duration was established.
- The detailed incremental change of necrotic area was delineated.
- New therapeutic choices of flap loss can be developed by proper use of the model.