

# Frontal Sinus Fractures

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# Anatomy & Embryology

- Absent at birth
- Doesn't begin development until about 2 years of age
- Radiographically evident at about 8 years
- Adult size at about 12 years, but pneumatization continues slowly until about 40 years
- Consists of one or more compartments
- Irregular shape & asymmetric
- Lined by respiratory epithelium
- Intimate relation with cranial

# Anatomy

- Volume approx 5 mls
- Anterior wall thicker/stronger than posterior wall
- Dura adheres to deep surface of posterior table
- Mucosal lining contiguous with ethmoidal air cells & nasofrontal ducts
- Foramina of Breschet → venous drainage of mucosa are site of potential intracranial spread of infection
- Mucosa deeply invaginates foramina

# Anatomical Variation


- 10% unilateral
- 5% rudimentary
- 4% absent
- 20% of people “abnormal” frontal sinus anatomy

# Nasofrontal Duct

- Drains frontal sinus
- Located posteromedial floor of sinus
- Very variable course
- True duct is absent in 85% people
  - FS drains indirectly via ethmoidal air cells to middle meatus

# Examination

- Full assessment as per ATLS
- Lacerations
- Depression
- CSF leak

A close-up photograph of a surgical incision on a patient's forehead. The incision is a deep, vertical cut that has been made through the skin and subcutaneous tissue. The edges of the incision are slightly retracted, revealing the underlying structures. The skin around the incision is reddened and appears to be under tension. The background is a dark, out-of-focus area, likely the patient's hair or the operating room environment. The text "Dr. Peter Aquilina©" is overlaid on the right side of the image.

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# Investigations

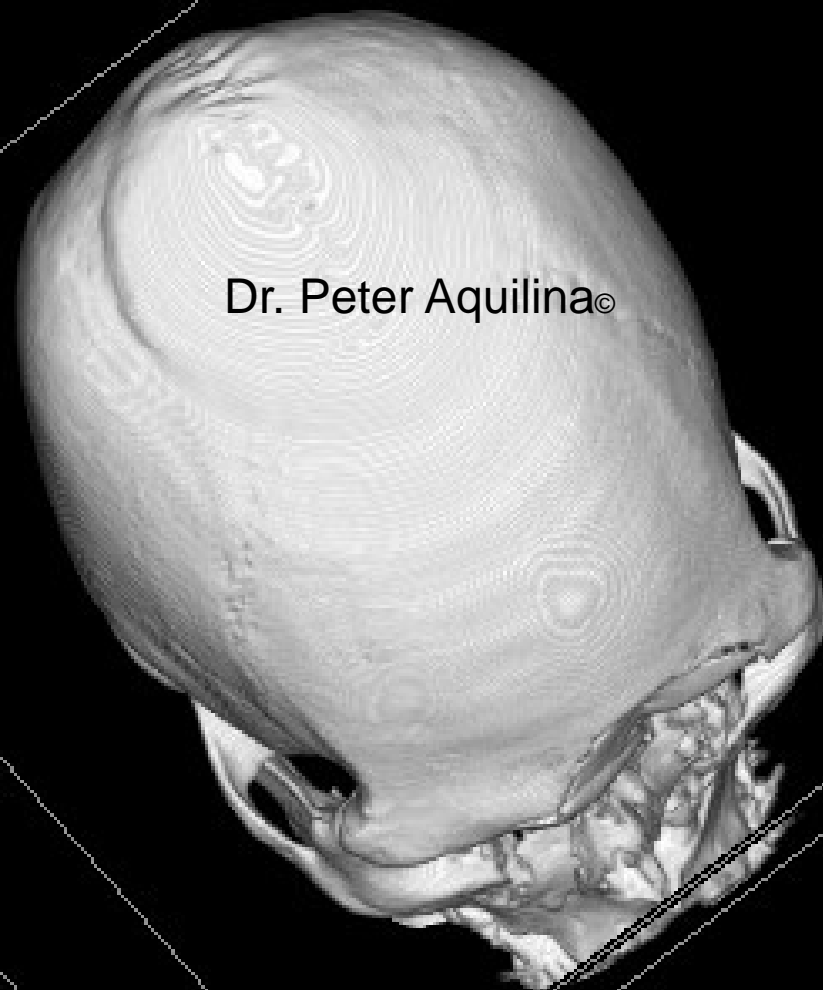
- CT imaging modality of choice
  - Request axial and coronal slices
- Beta Transferrin → CSF
- Other investigations as required



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# Associated injuries

- Neurological
  - Closed head injury
  - Pneumocephalus
  - Cerebral contusions
  - Haematomas
  - Open brain

# Associated injuries

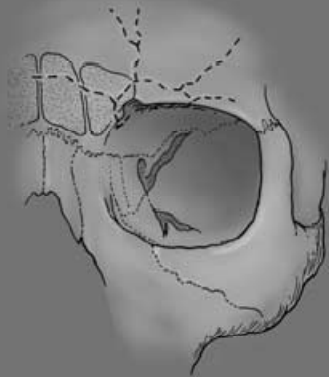
- Ophthalmological
  - Up to 25%
  - Full ophthalmological examination mandatory

# Associated injuries

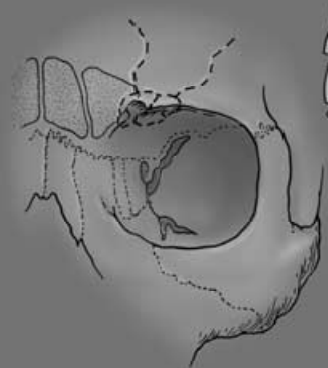
- Maxillofacial injuries
  - NOE
  - ZMC
  - Le Fort fractures
  - Panfacial fractures

# Classification of Frontal Sinus Fractures

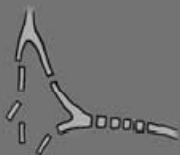
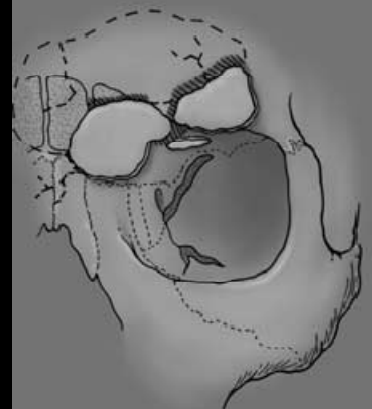
- Many classification systems
- Can get very detailed classification, however not useful clinically



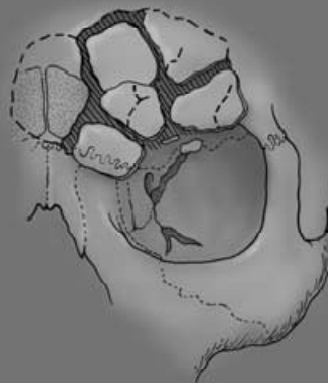
Type 1



Type 2



Type 3



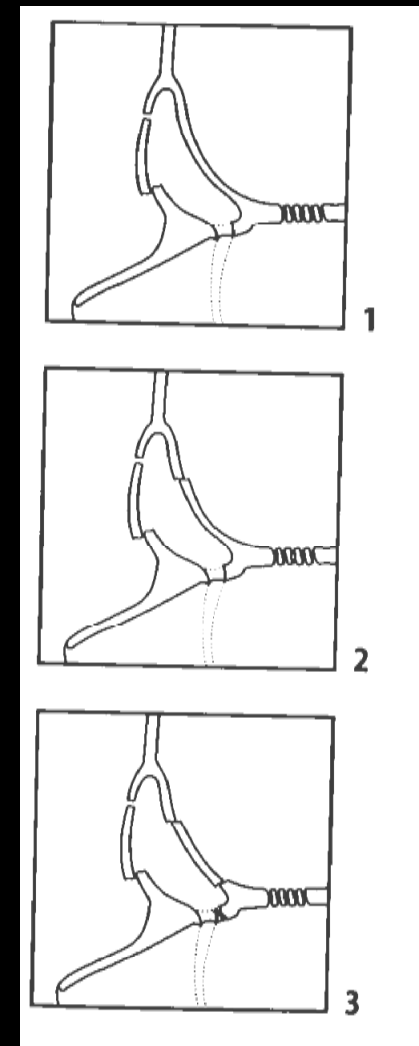
Type 4



Type 5

# Clinical Classification

- Anterior Table
  - Displaced
  - Un-displaced
- Posterior Table
  - Displaced
  - Un-displaced
- Anterior & Posterior Table
  - Displaced
  - Un-displaced
- Nasofrontal Duct
  - Involved
  - uninvolved





# Simplified Clinical Classification

1. Fracture of anterior table
2. Fracture with disruption of posterior wall
3. Fracture involving floor of sinus

# Surgical Management

Goal = “Safe Sinus”

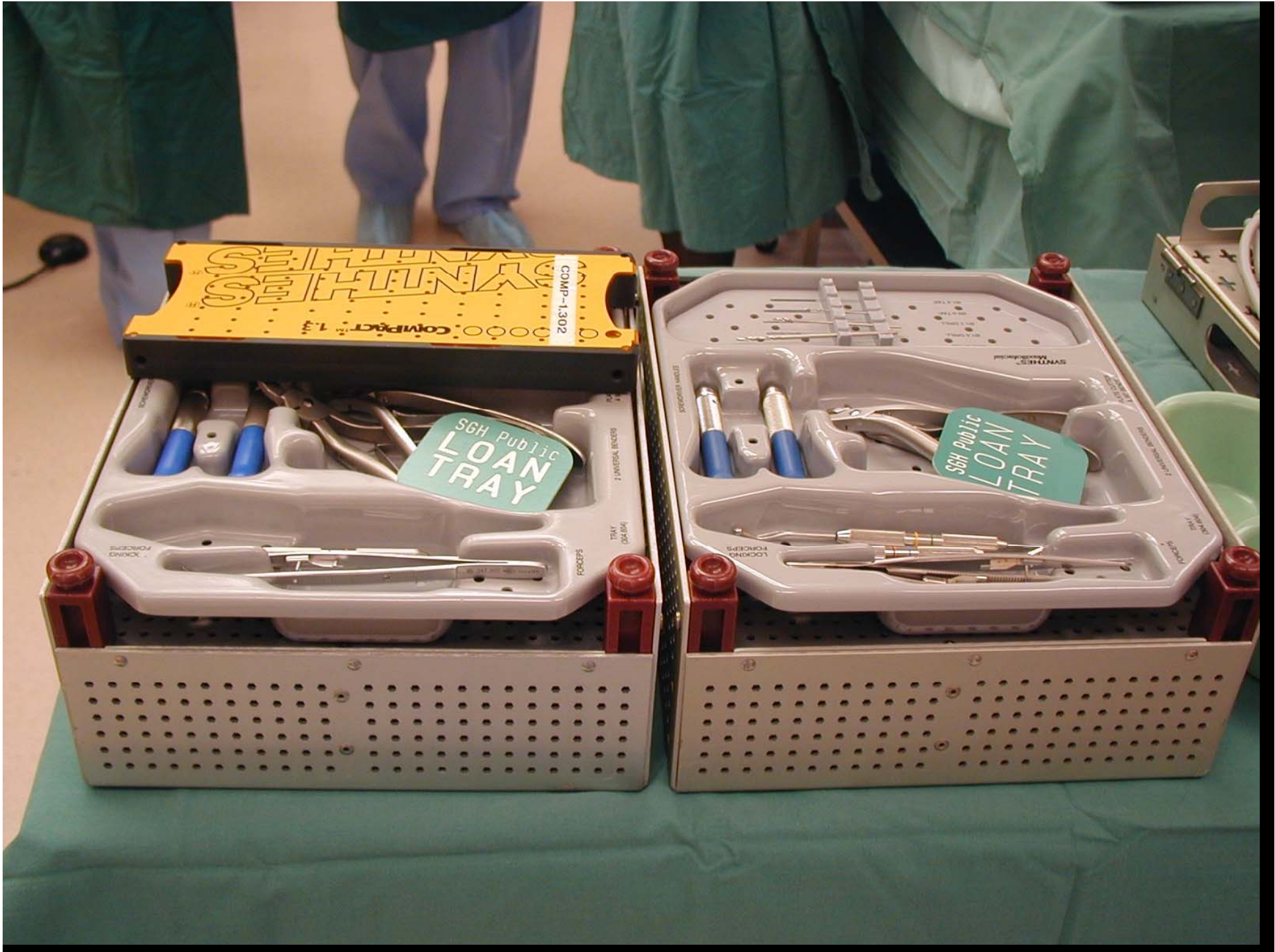
# Anterior Table Fractures

- Non surgical
  - Undisplaced
  - Minimal displacement with no cosmetic defect
- Surgical Intervention
  - Displaced fractures

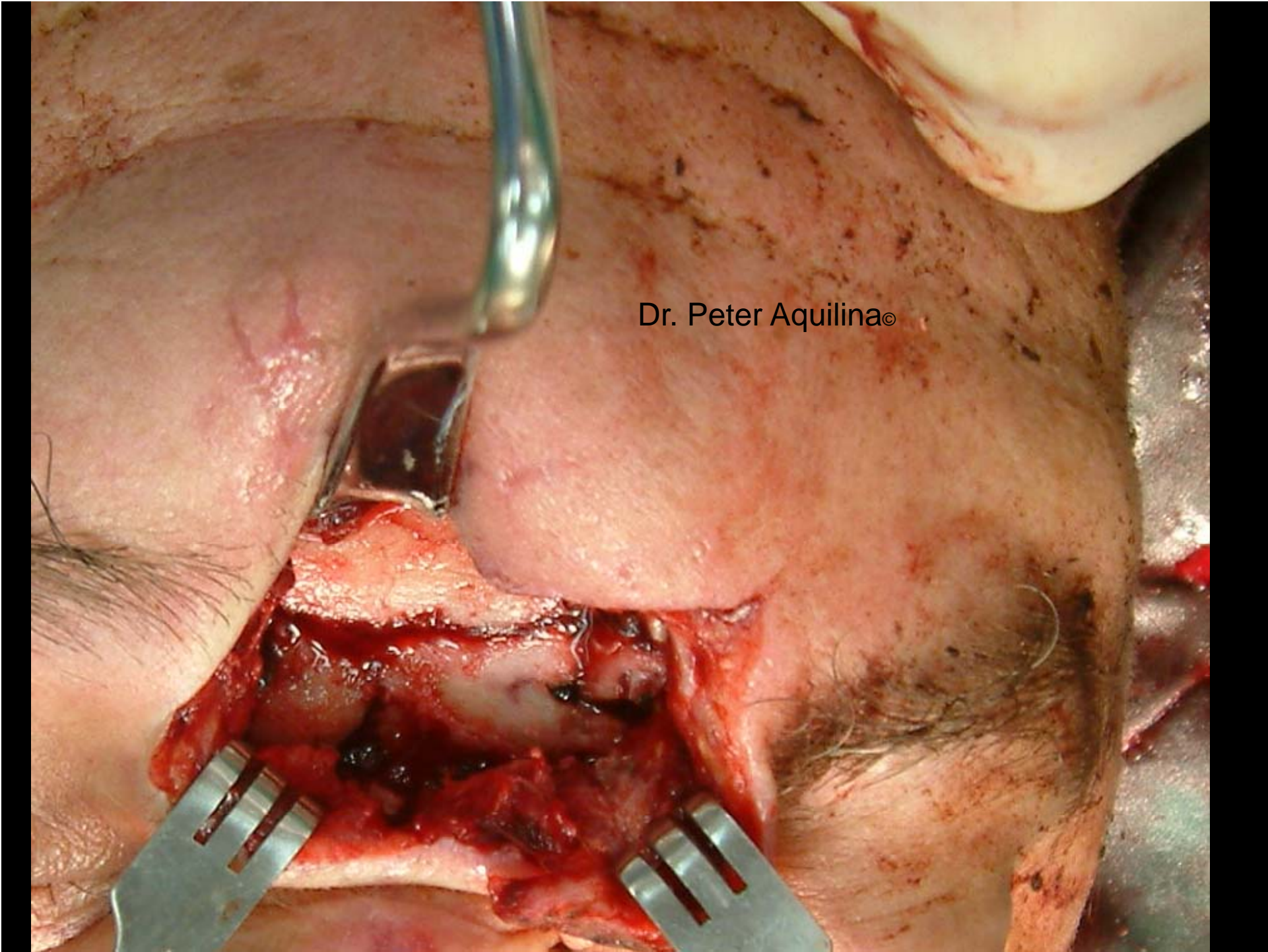
# Anterior Table Fractures

## Surgical Access

- Coronal flap preferable
- Generally avoid using lacerations or local incisions
- Avoid “Gull Wing” & “Open Sky” approaches
- Anatomically reduce fragments & hold in place with 1.3mm hardware



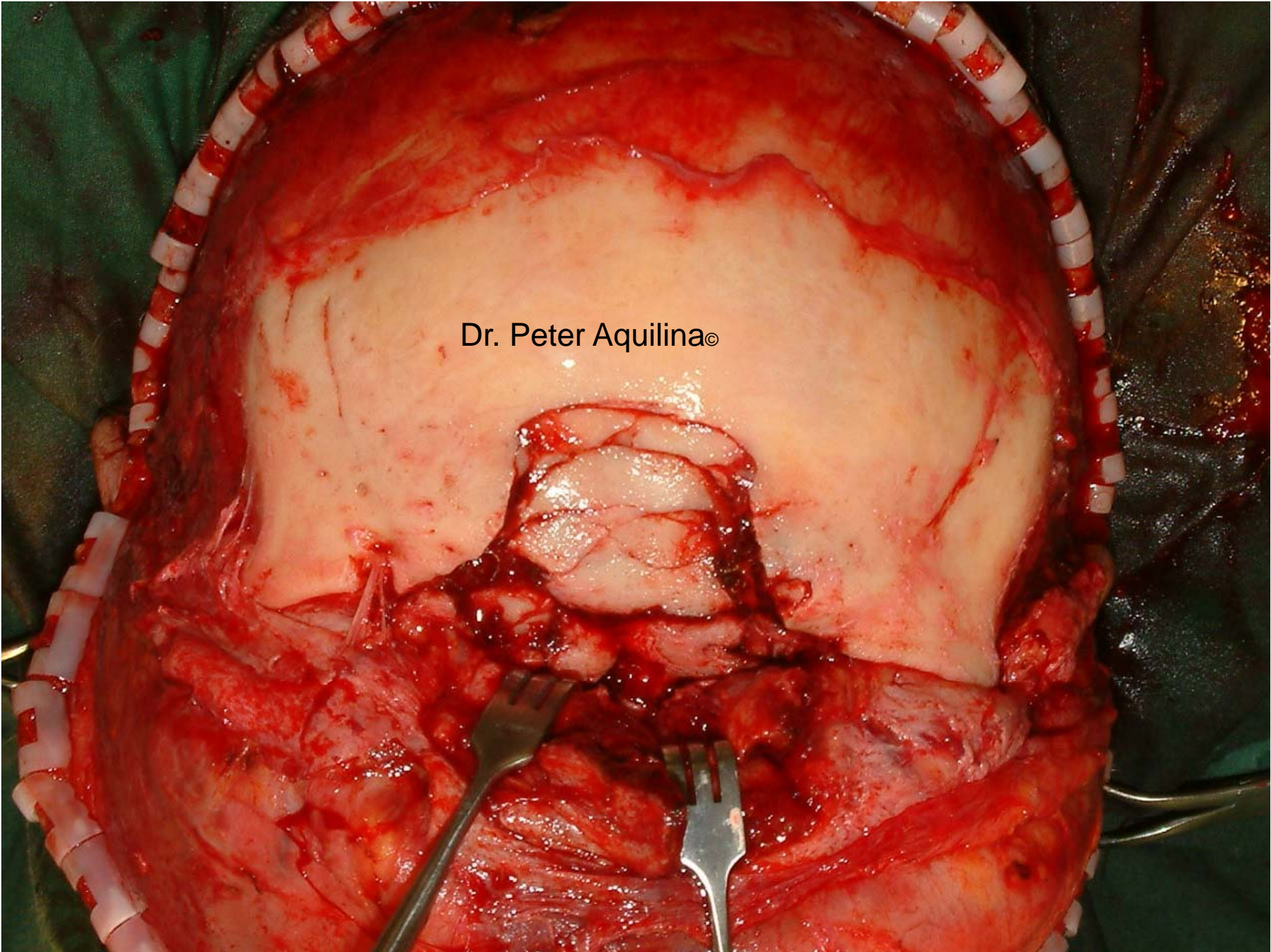




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This is an intraoperative photograph showing a surgical procedure on the maxillofacial region. The image captures a deep dissection, likely involving the maxilla and surrounding soft tissues. Several surgical instruments are visible: a large metal retractor is positioned at the top left to hold the lips and soft tissue back; two metal retractors are used at the bottom to stabilize the surgical field; and a pair of surgical forceps is visible on the right side. The surgical site is characterized by exposed bone, muscle, and soft tissue, with visible blood and surgical drapes. The text 'Dr. Peter Aquilina©' is overlaid in the center of the image.

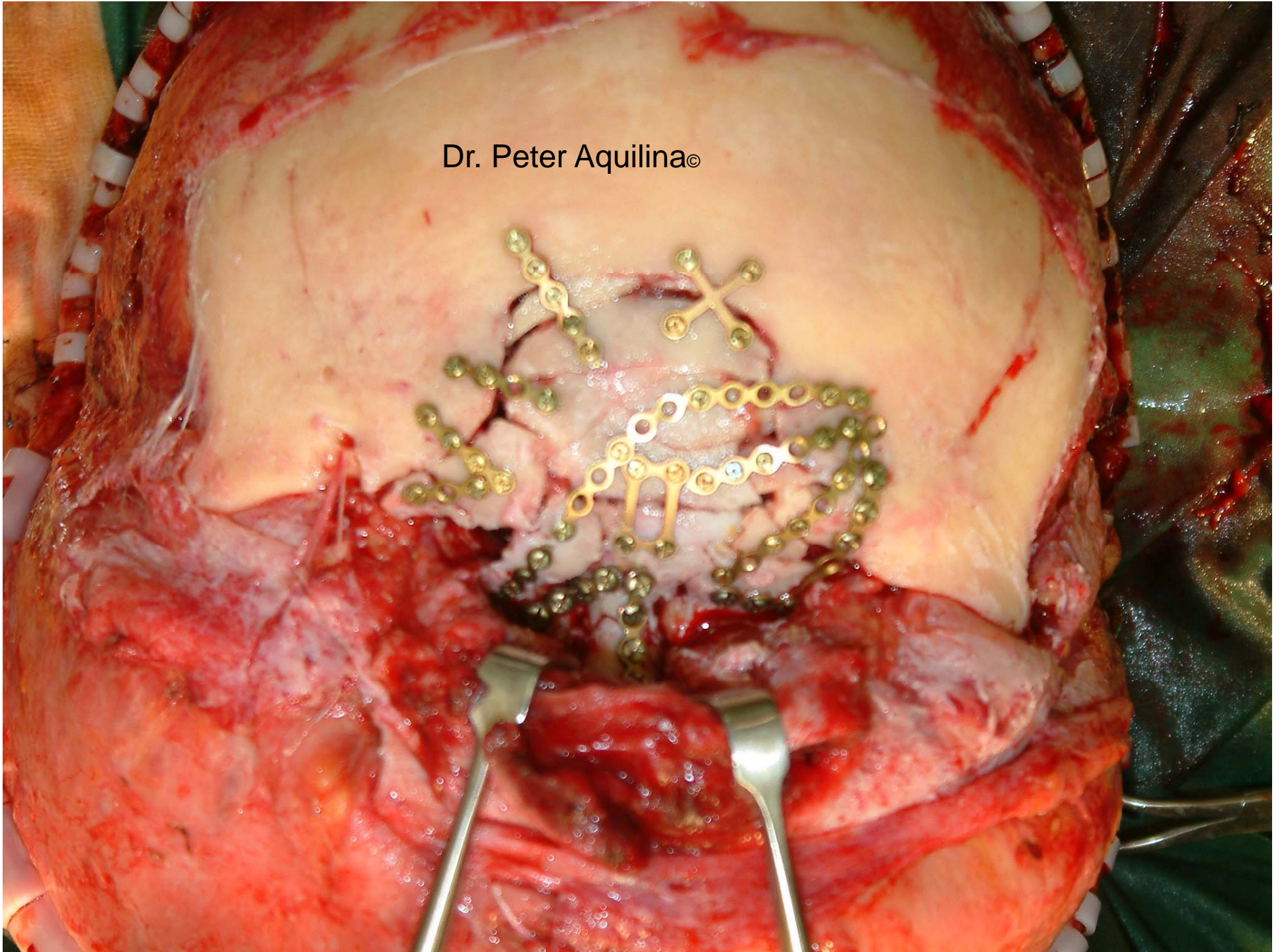




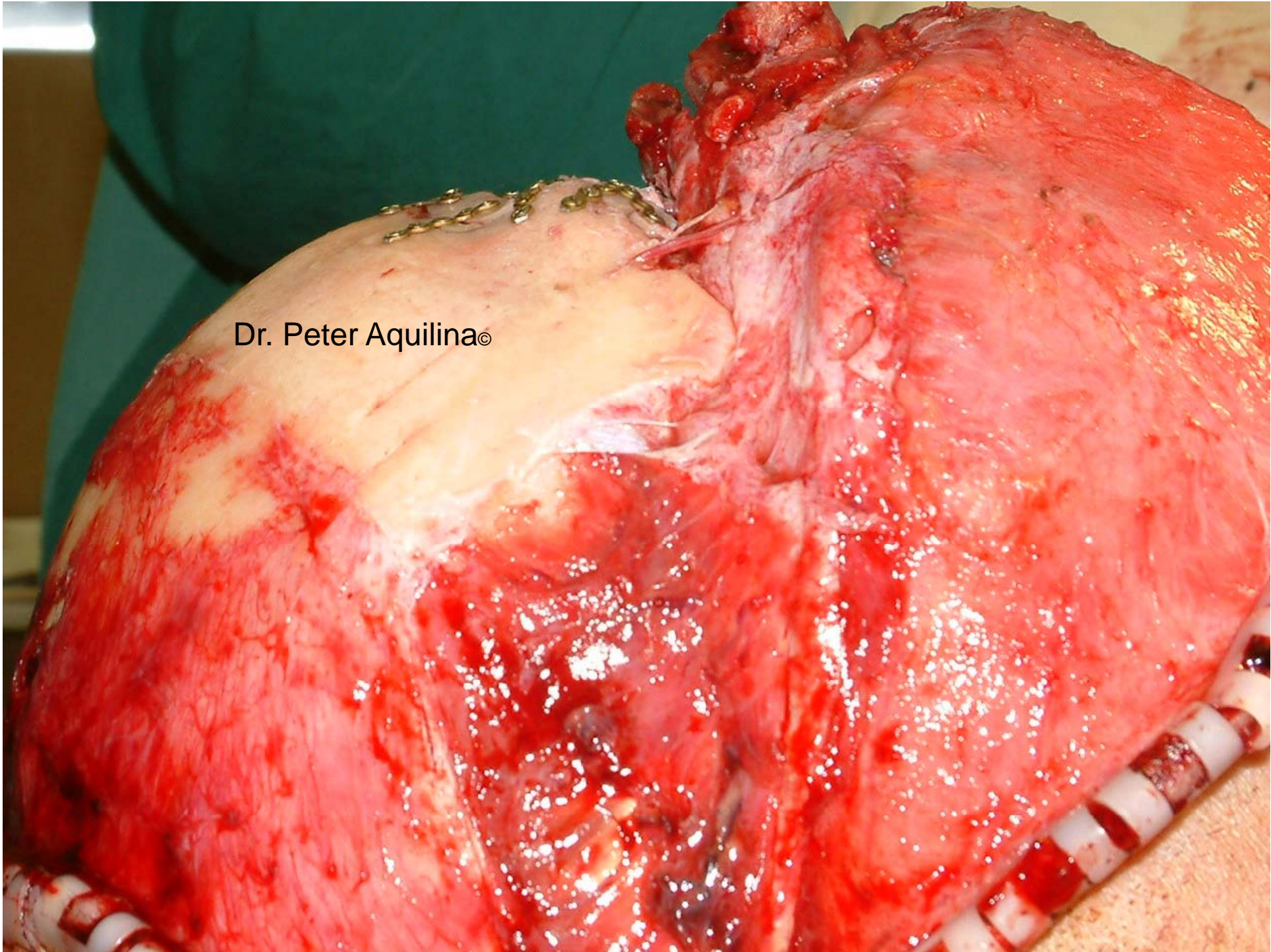
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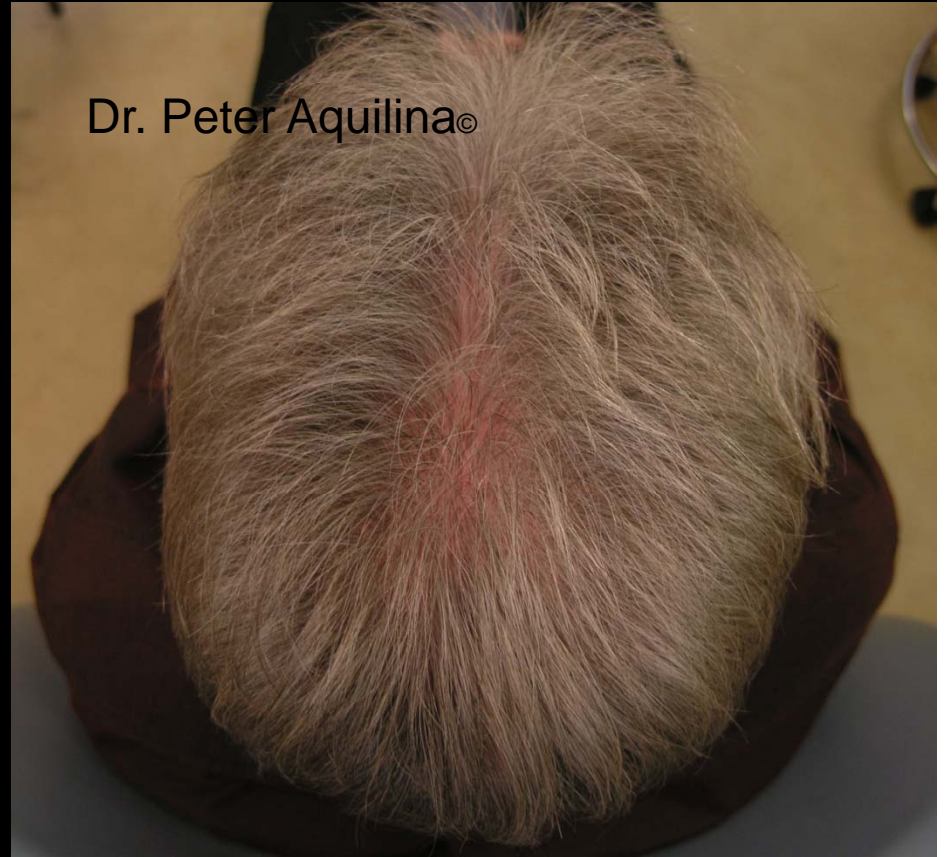




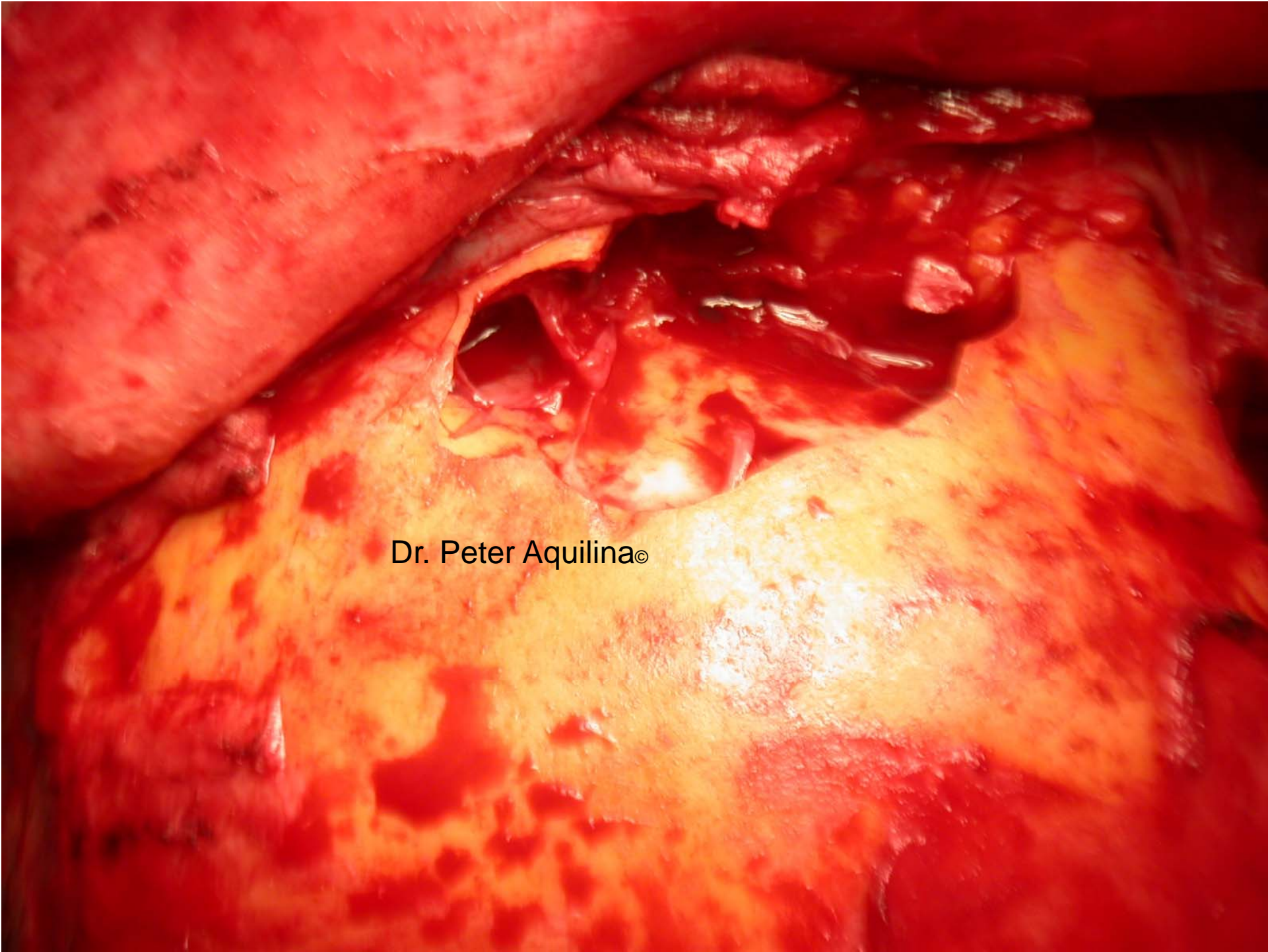


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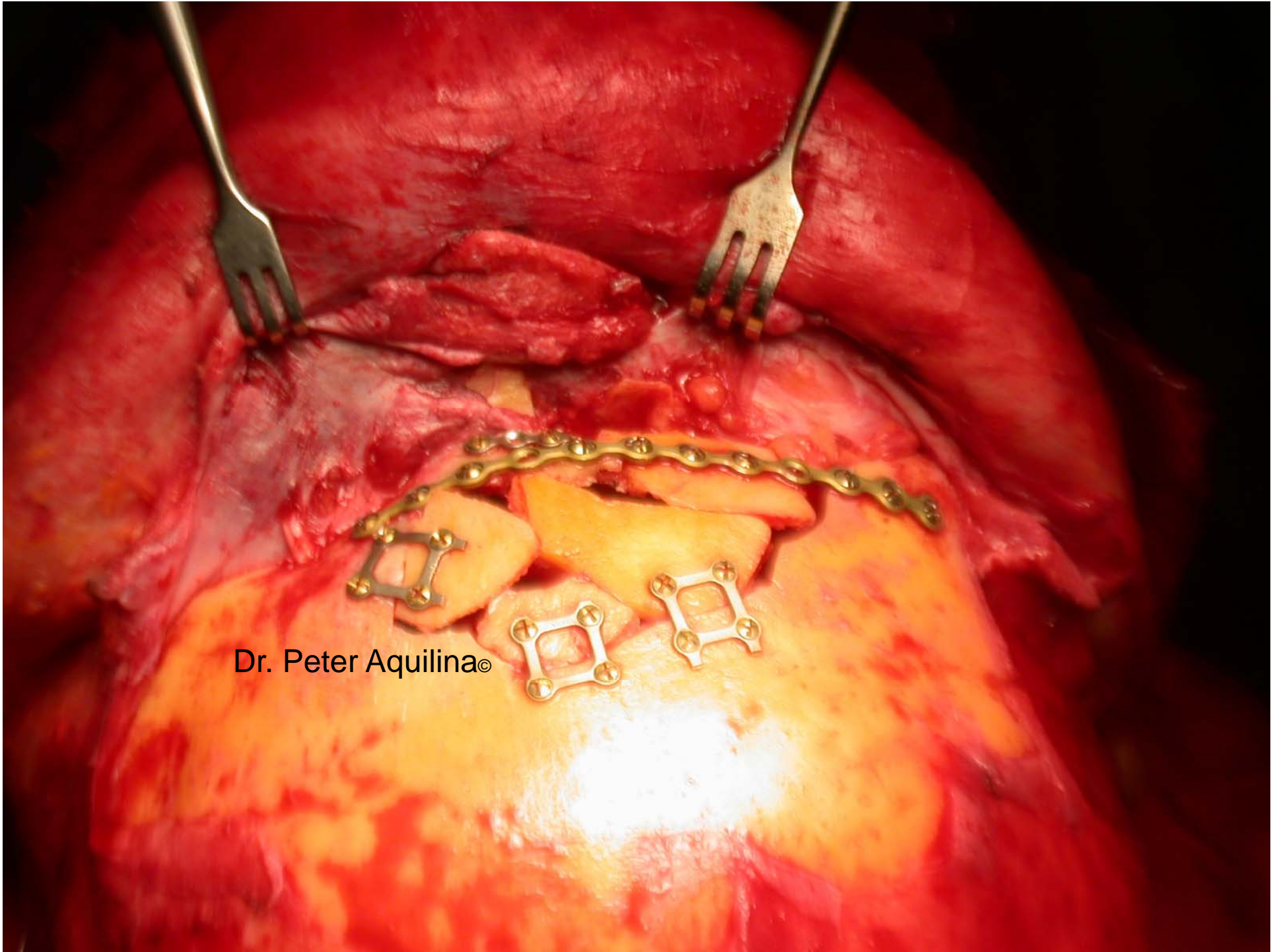


**Anterior Table with Bone Loss**



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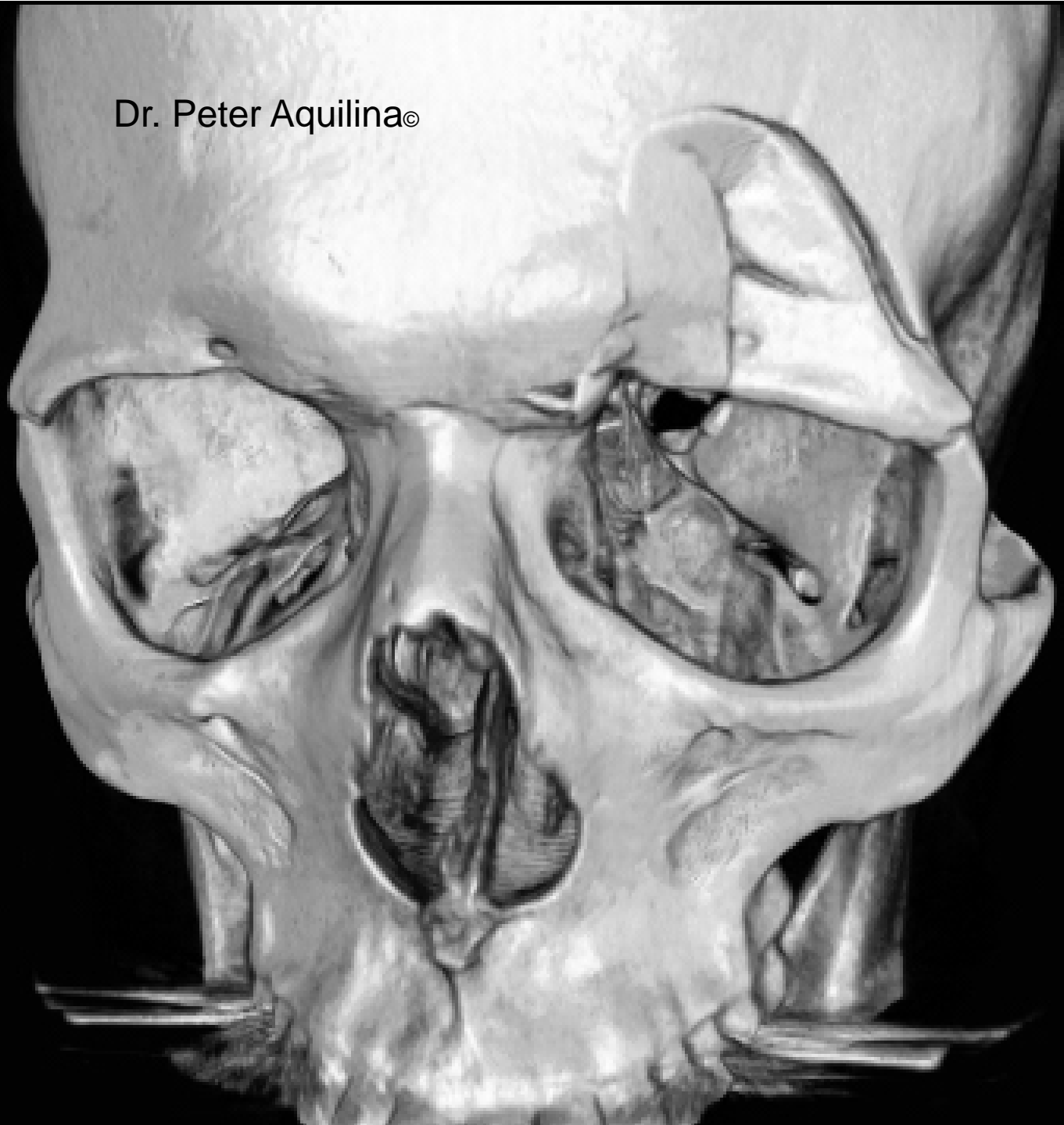




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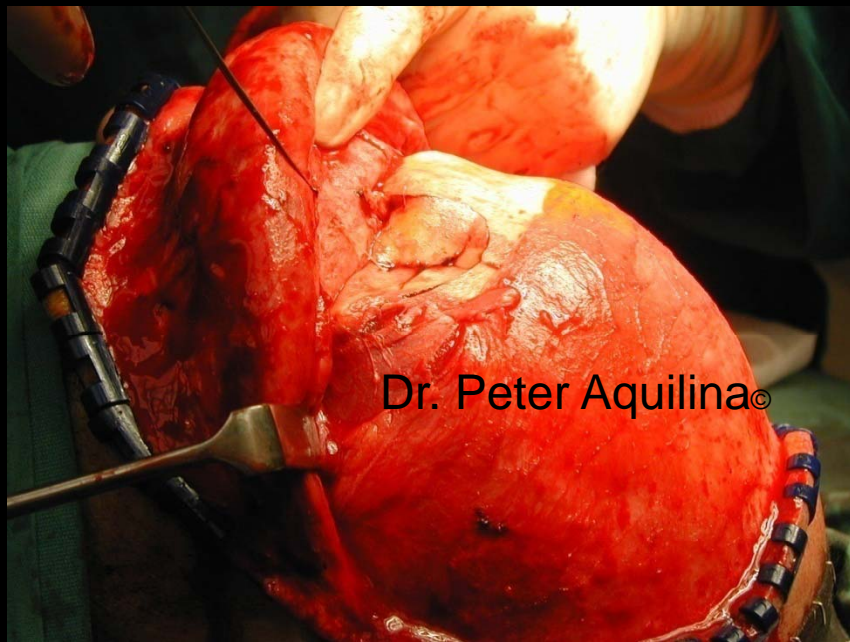
# Frontal Sinus with Orbital Roof

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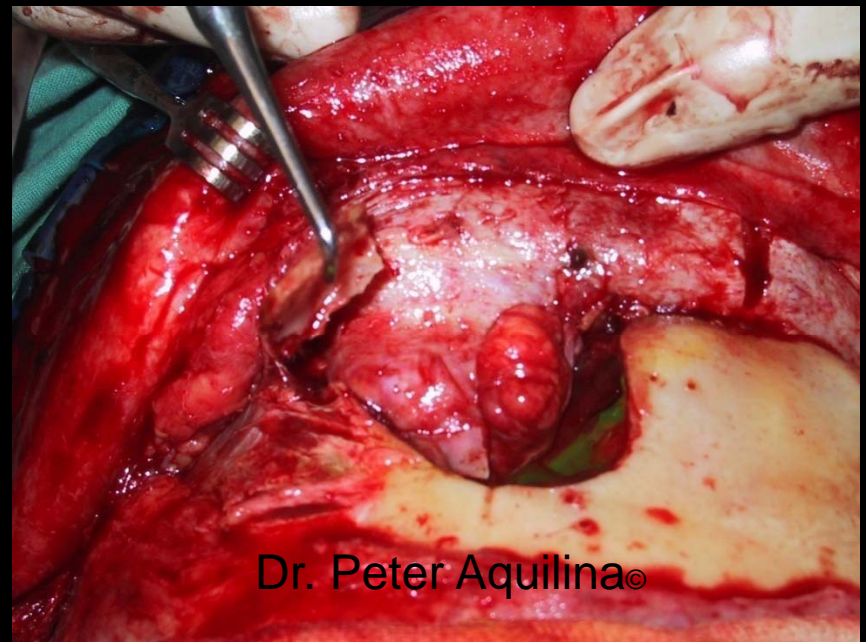






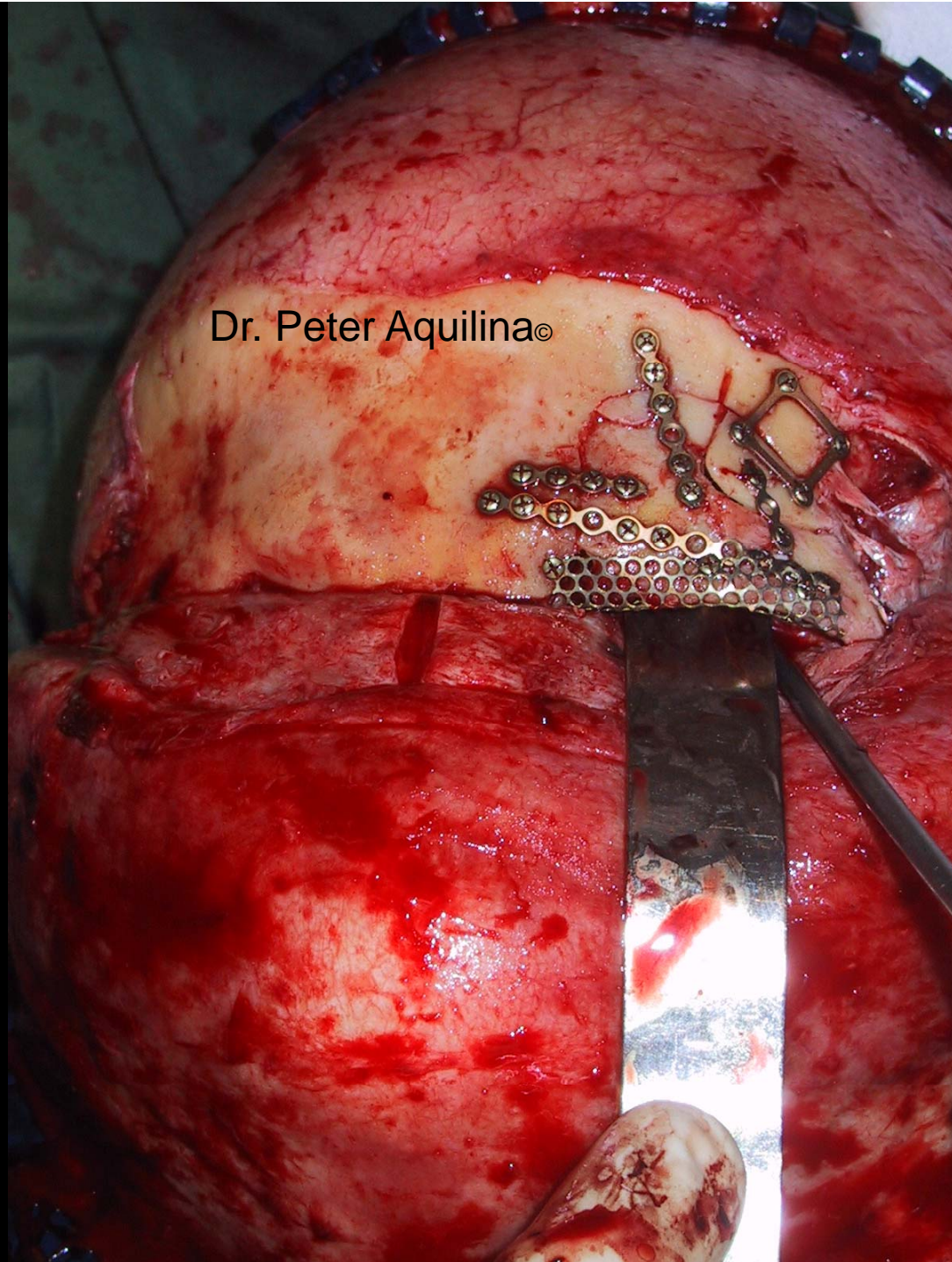


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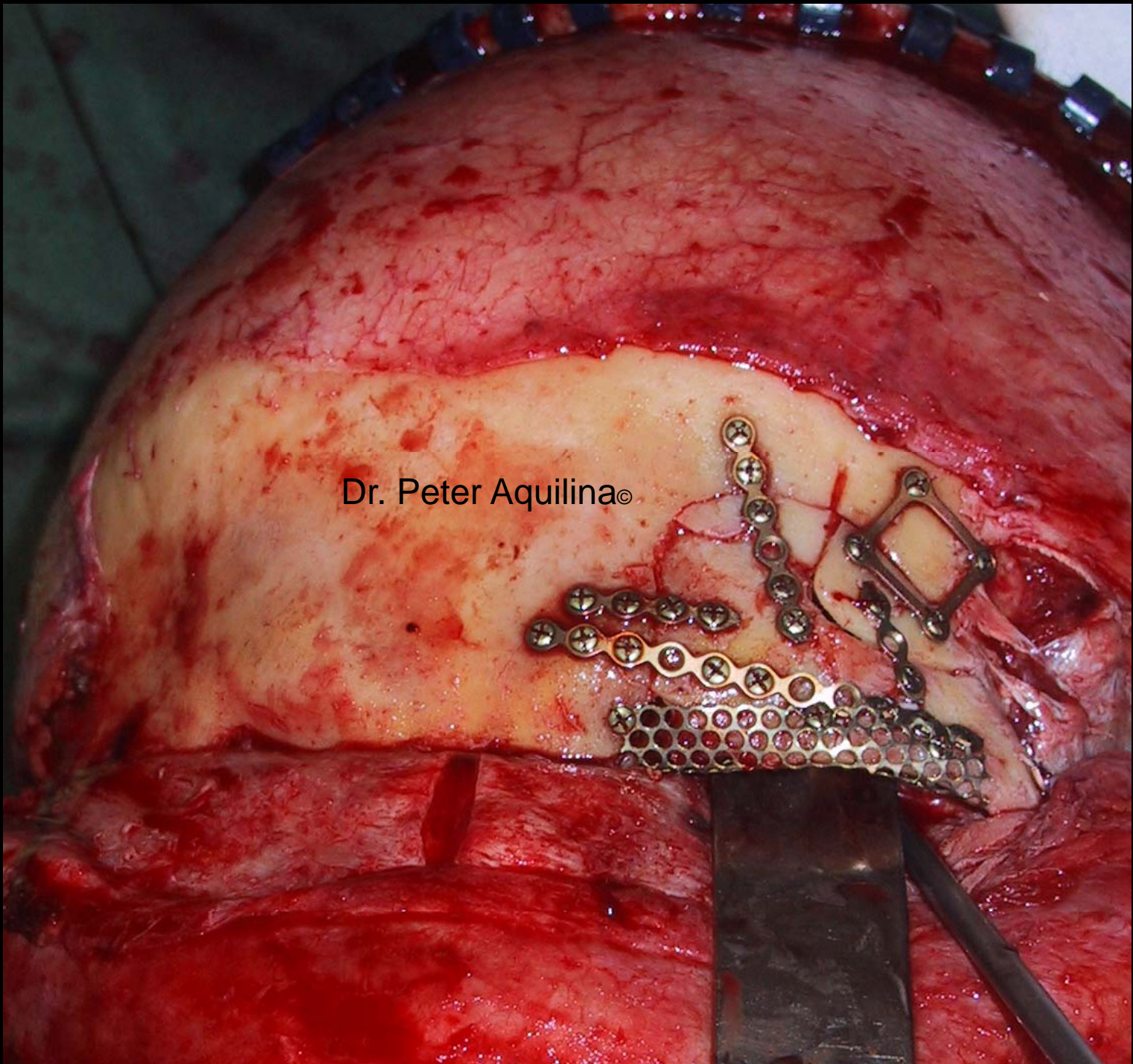


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# Fractures with Disruption of the Posterior Table

- Non-Surgical management
  - Undisplaced fractures
- Surgical Management
  - Displaced fractures
    - Displacement more than thickness of posterior table
  - Clinical findings suggestive of significant dural tear
    - Encephalocoele
    - Persistent CSF leak

# Surgical Management of Posterior Table Fractures

Cranialization

Vs

Obliteration

# Obliteration

- Frontonasal ducts obliterated, mucosal lining removed and sinus “packed”
- Various materials advocated
  - Fat
  - Muscle
  - Bone
  - Hydroxyapatite

# Cranialization

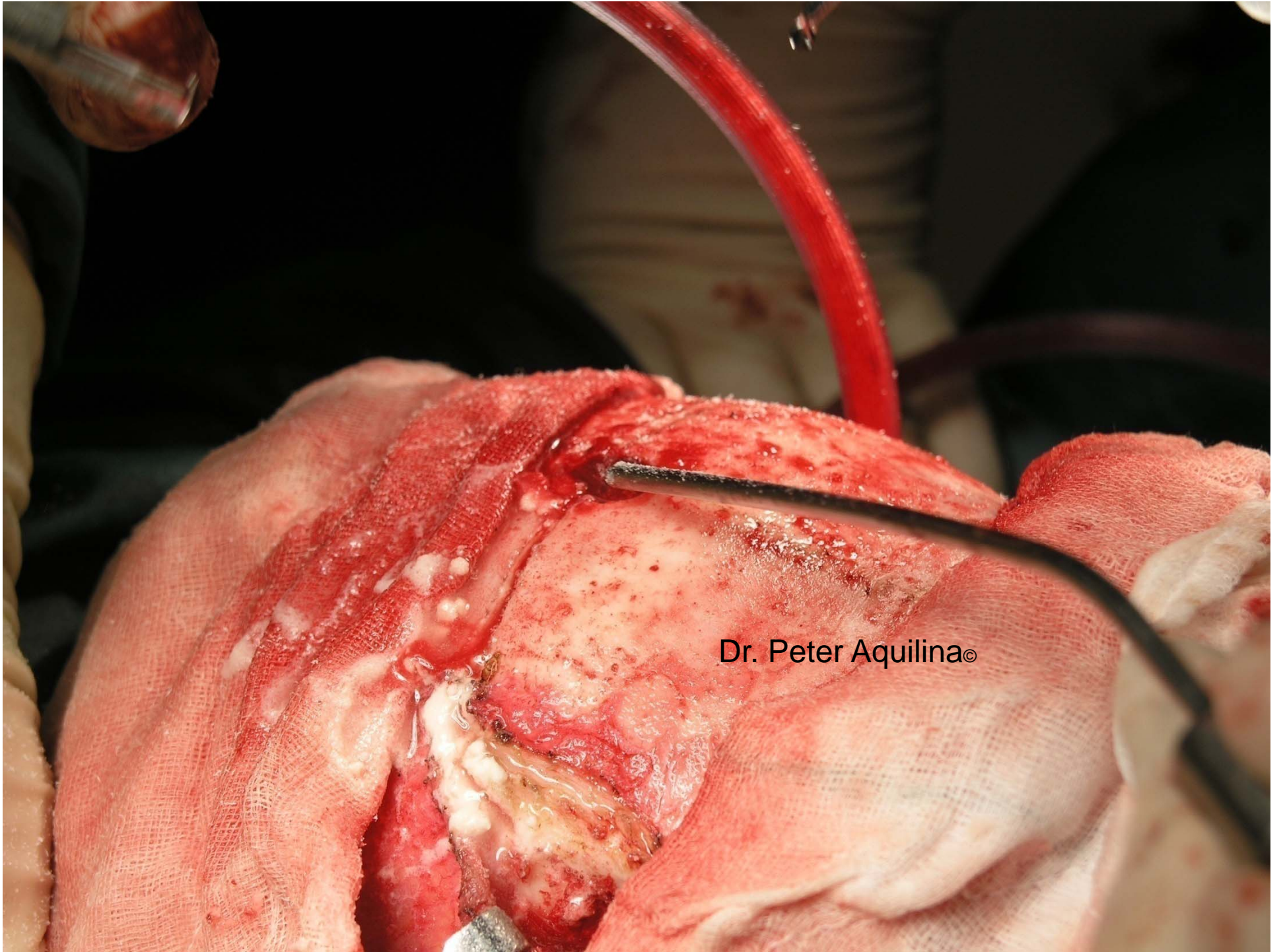
- Frontal craniotomy
- Dural repair
- Removal of posterior wall
- Removal of mucosal lining
- Plugging of nasofrontal ducts
- Galeal flap placed



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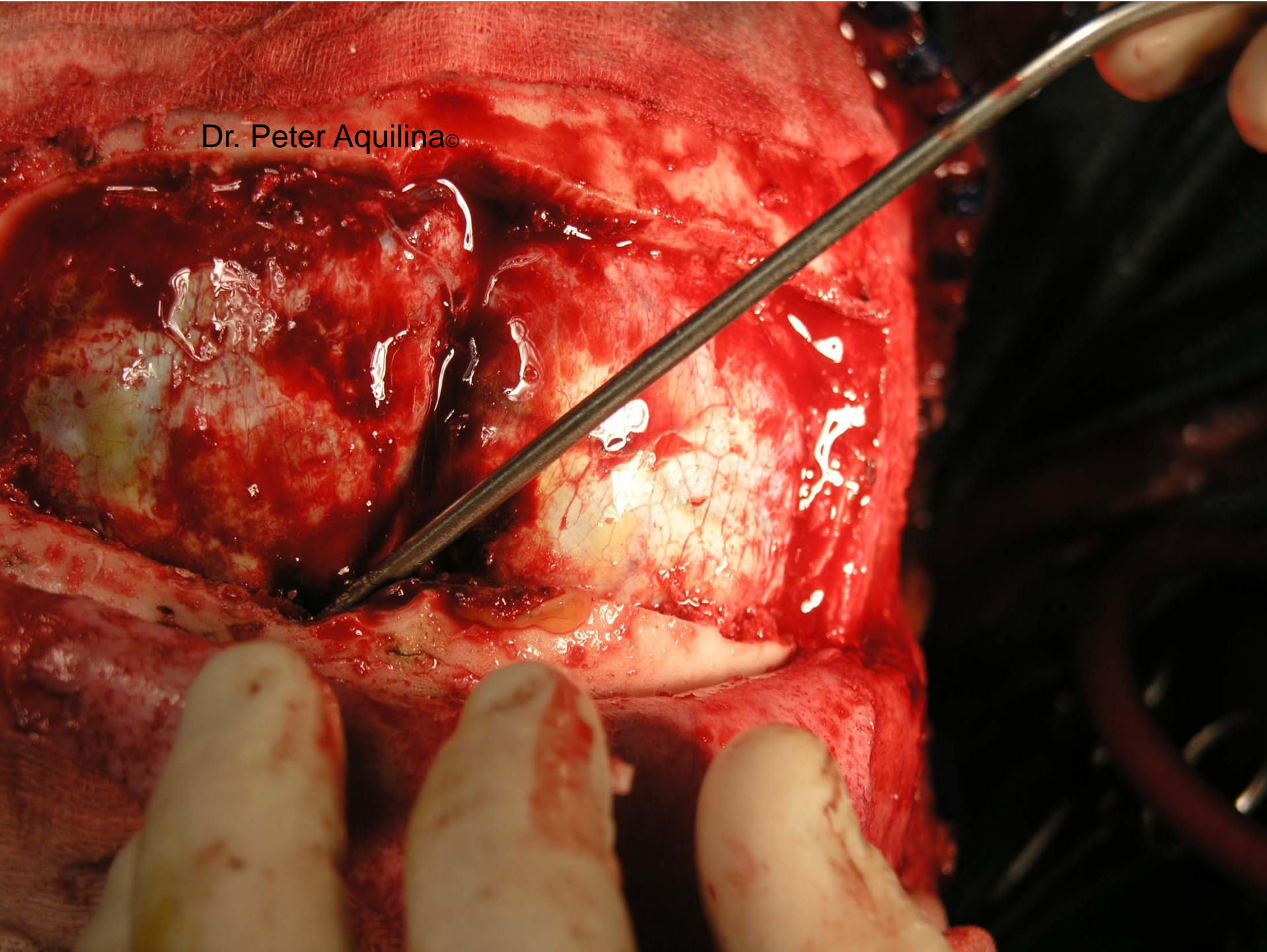




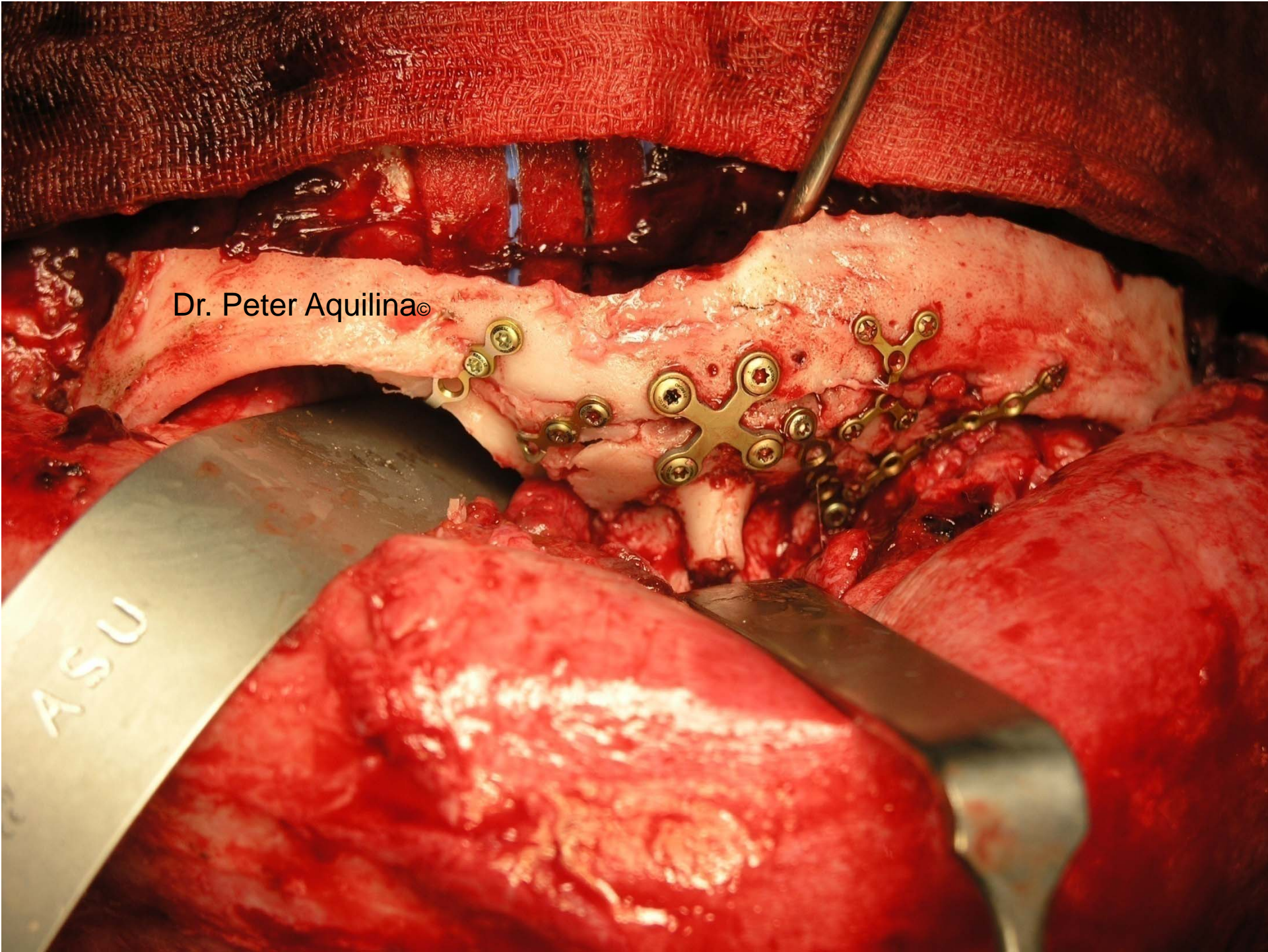
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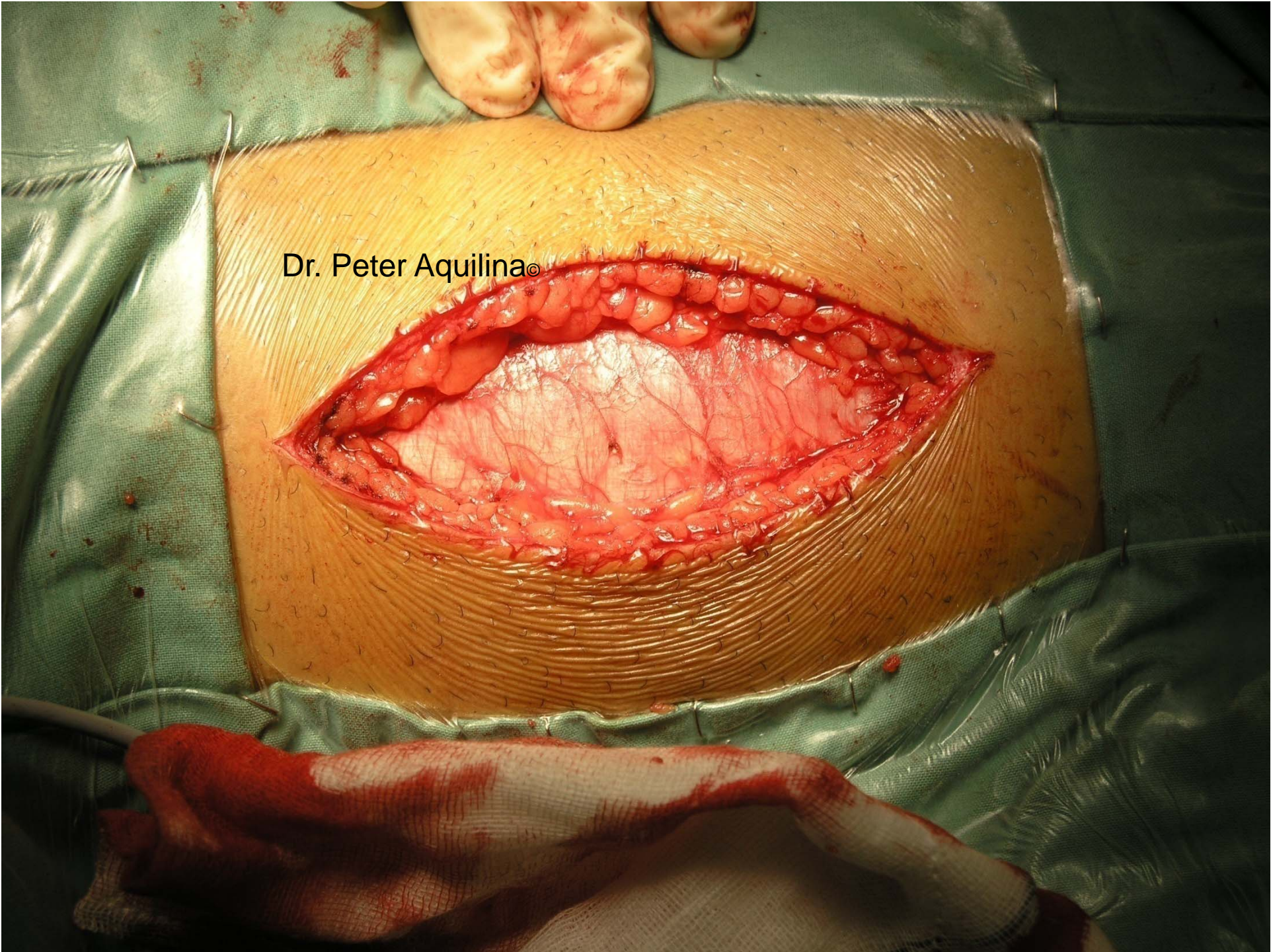






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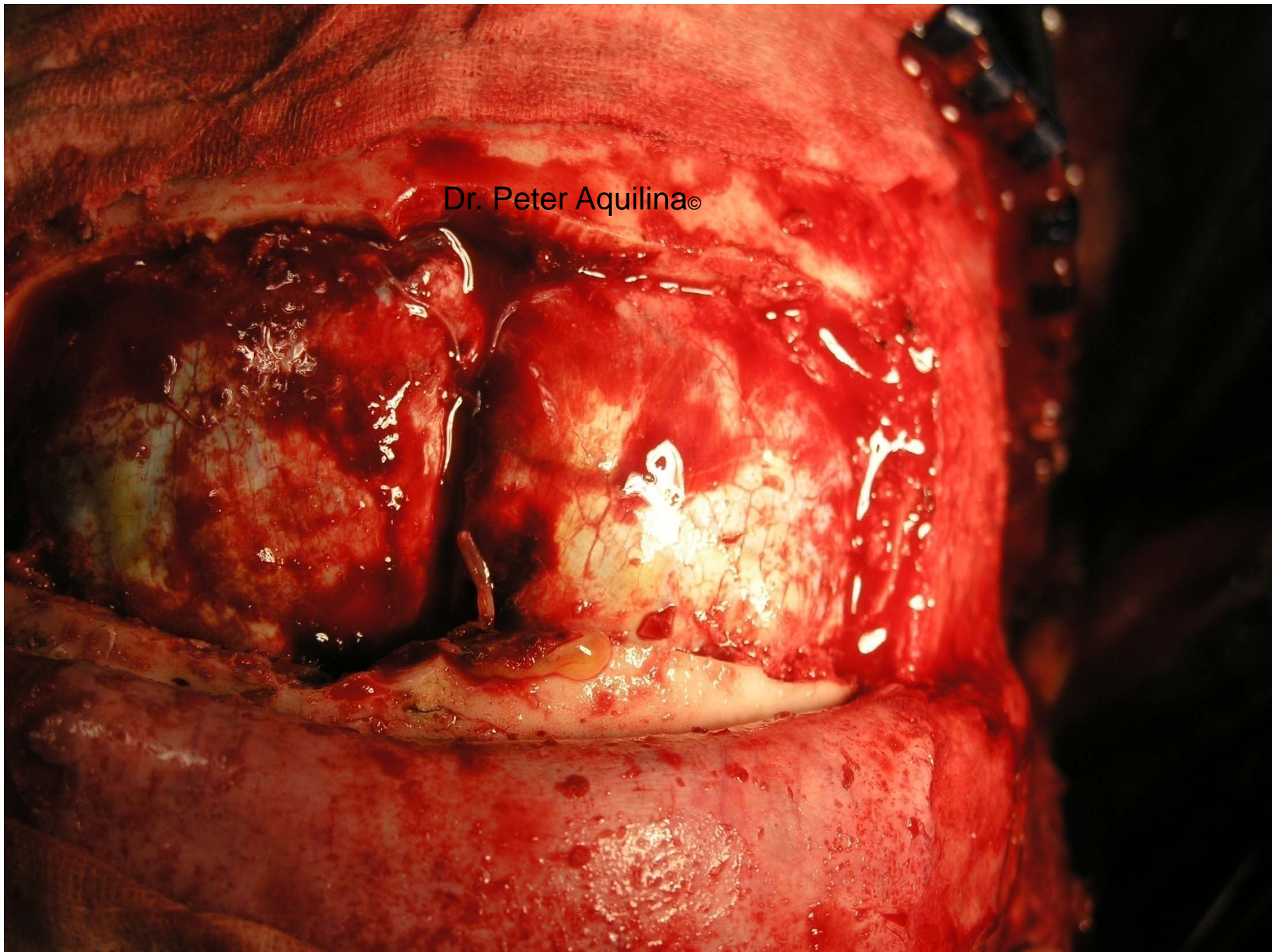




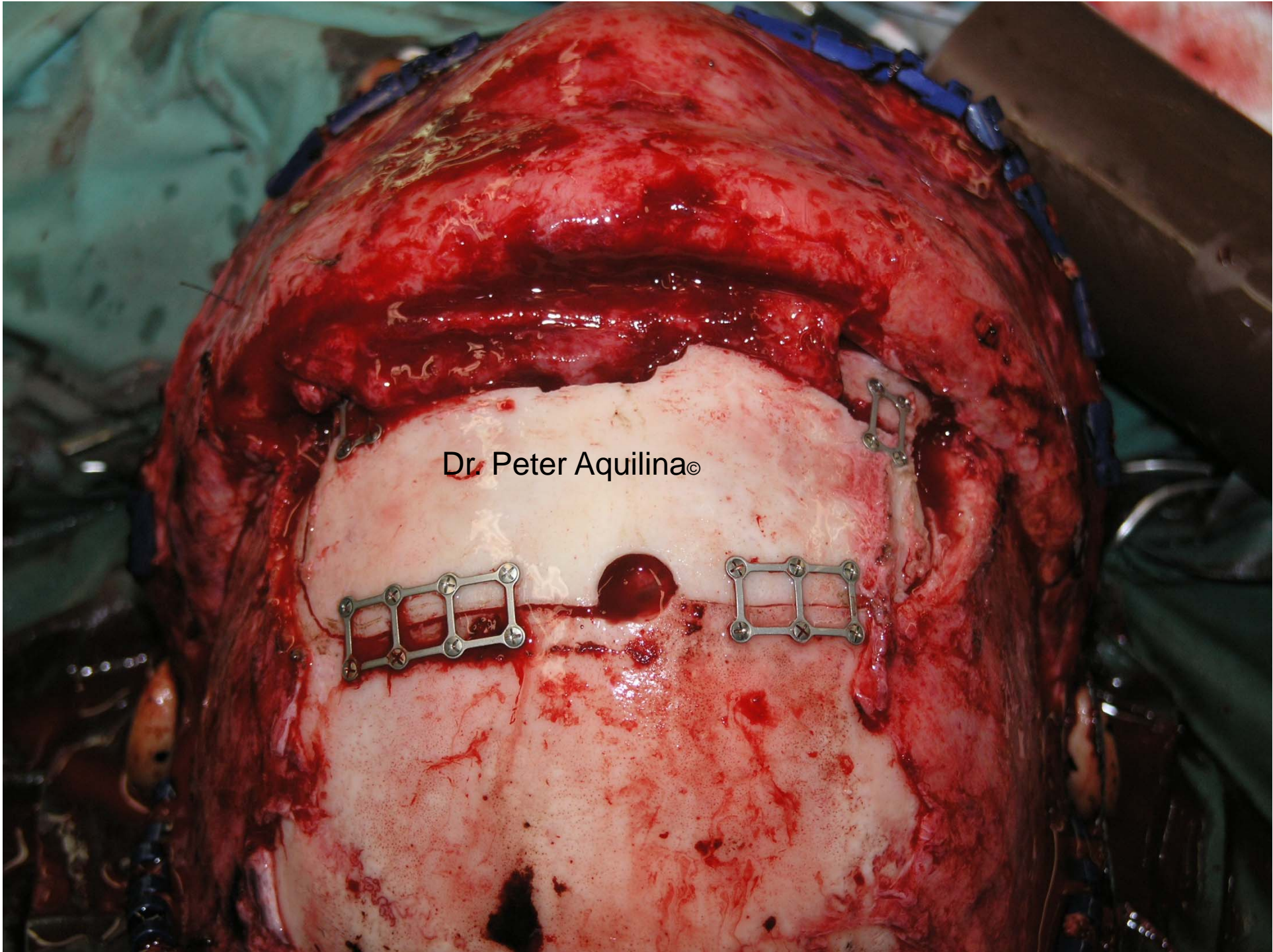
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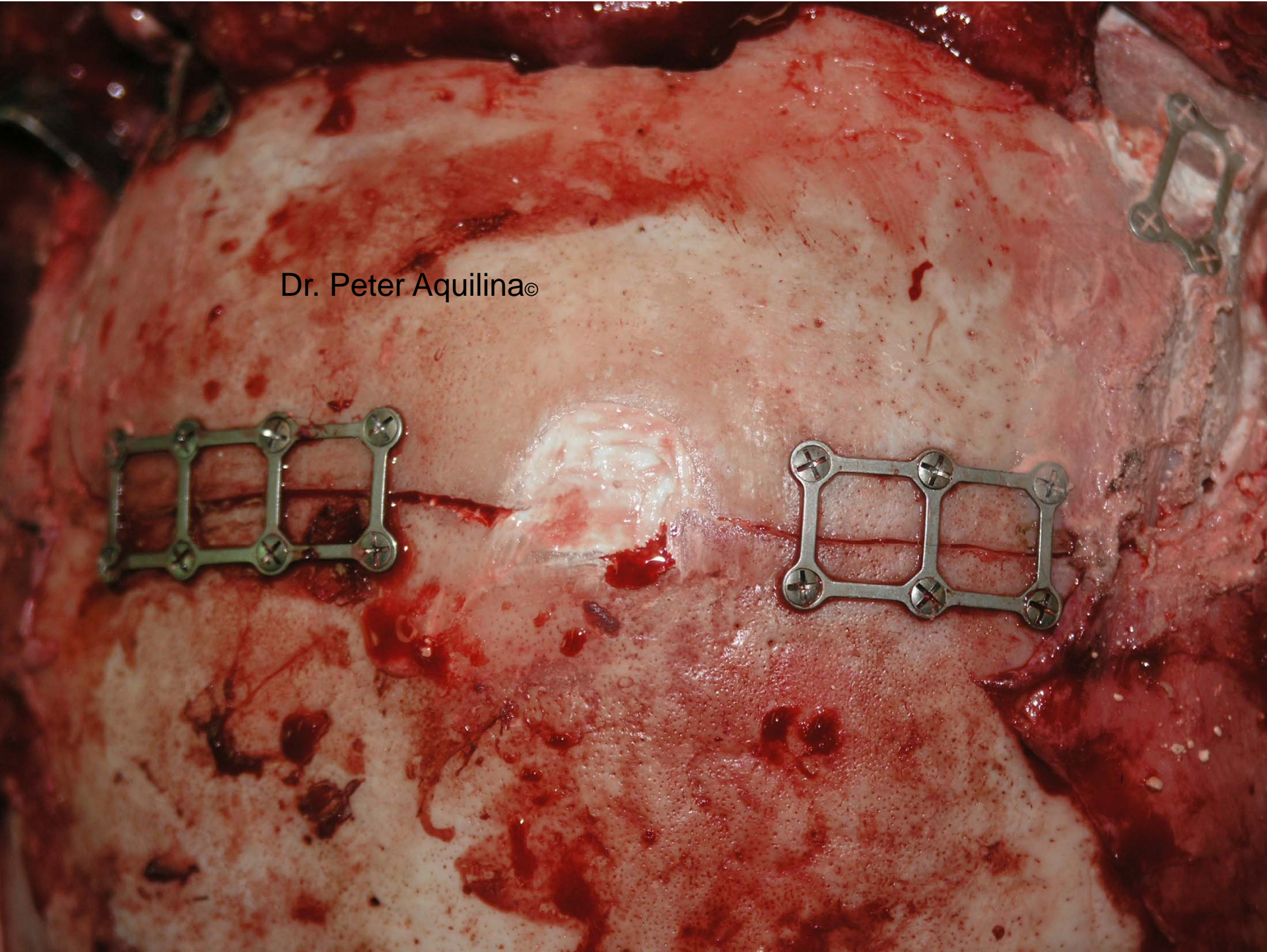
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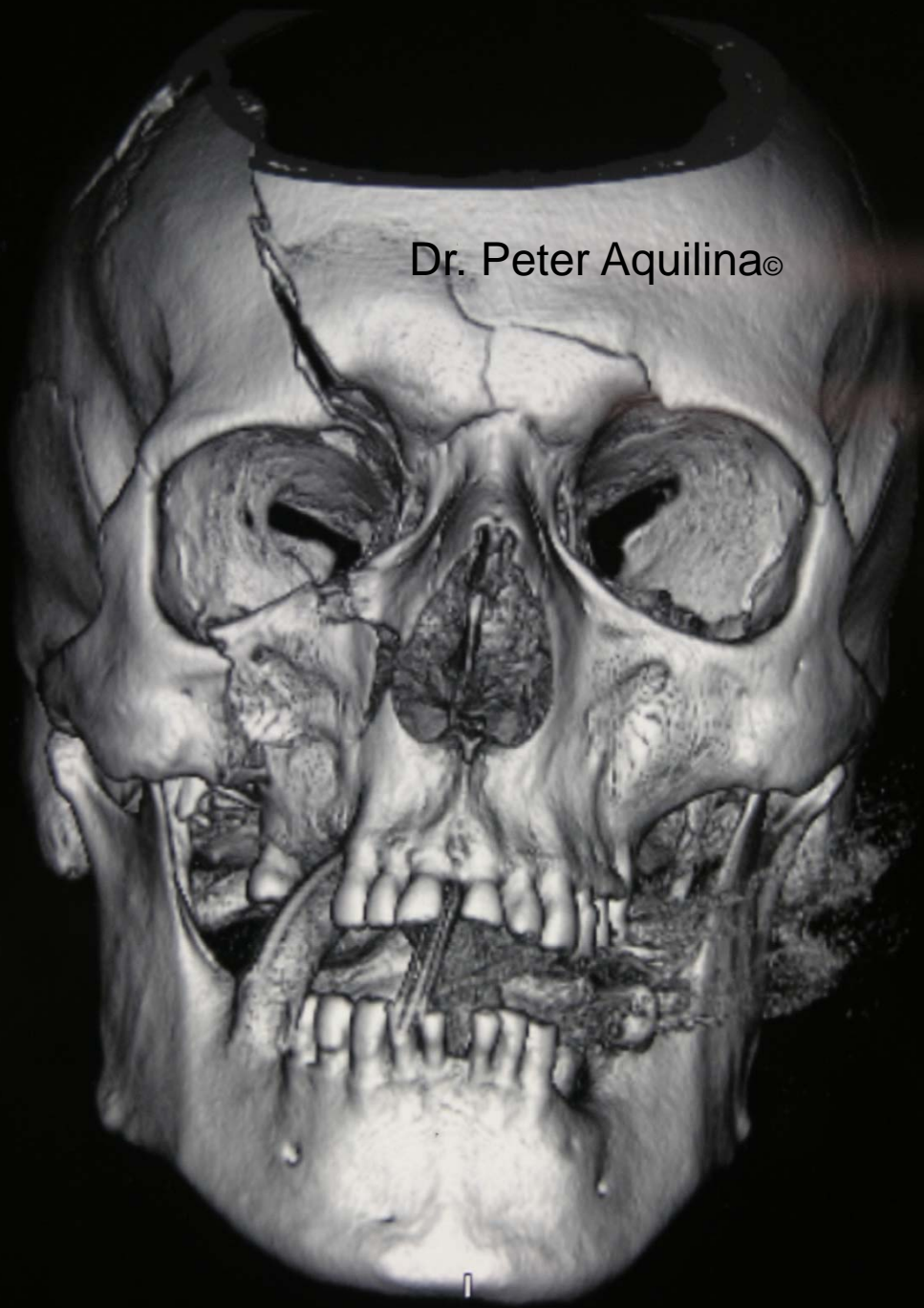
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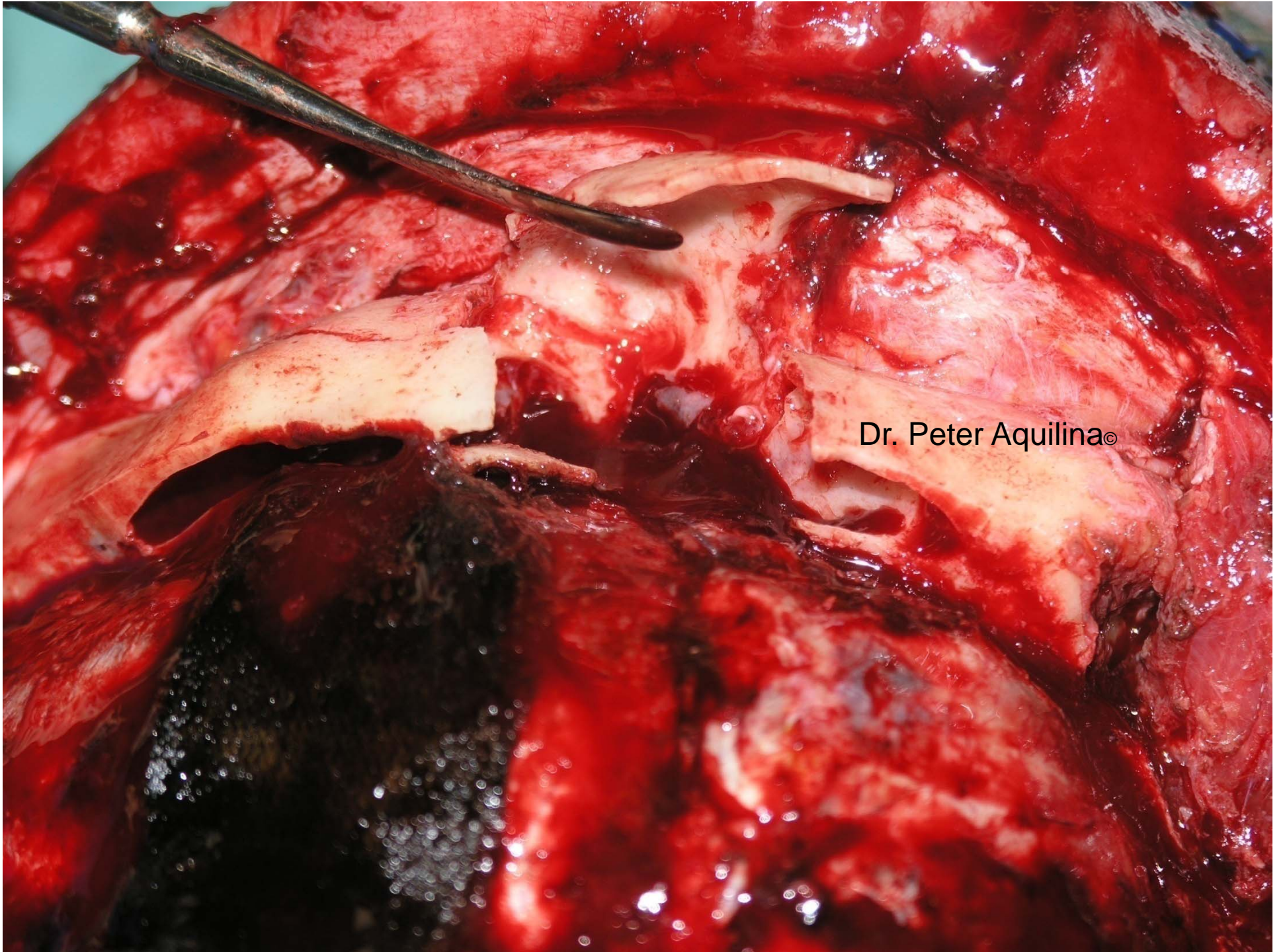


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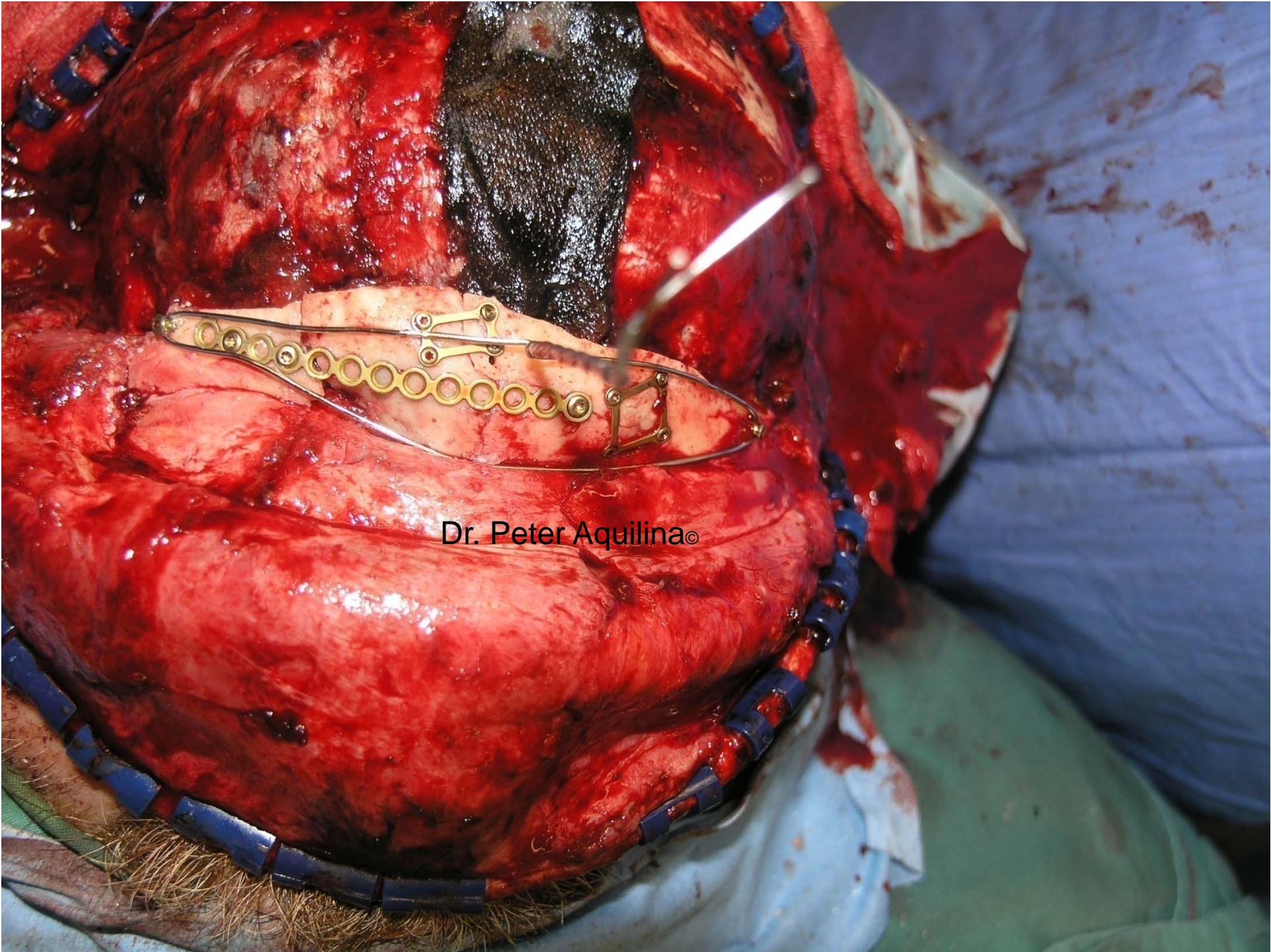






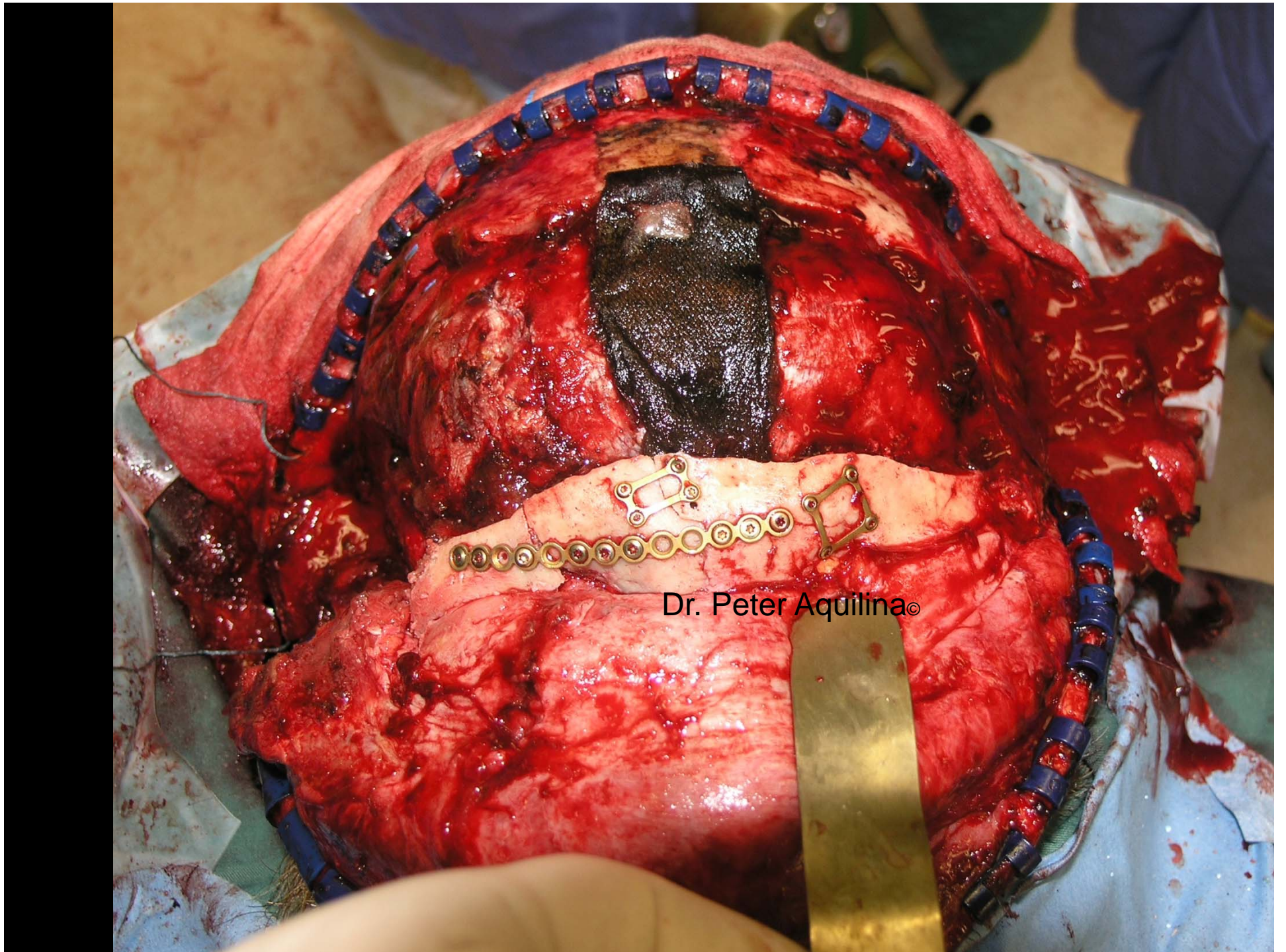
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# Fracture of the Floor of the Frontal Sinus

- Unusual in isolation
- Usually associated with NOE fractures
- ? Treat isolated floor fracture to prevent mucocoele formation
- If isolated floor fracture & sinus clinically draining satisfactorily may opt to leave alone
- Accurate reduction of fractures → can expect NFD function to resume (Gruss)

# Management of the Nasofrontal Duct

- Role of drainage via nasofrontal duct may be overstated in trauma compared to infective sinusitis (Evans)
- Avoid trying to reestablish a frontonasal duct → prone to failure
- If radiological evidence of NFD disruption, explore and treat on merits
- NFD function most likely to return to normal with accurate anatomical fracture reduction.

# CSF LEAK

- Management controversial
- Surgical or non-surgical
- Prophylactic antibiotics?

# Prophylactic Antibiotics

- incidence of meningitis between 3-50%
- Mortality about 10%
- Usually pneumococcus spp.



# Prophylactic Antibiotics

- EBM
  - Prophylactic antibiotics not recommended
  - Prophylactic antibiotics may increase incidence of meningitis by changing the pathogenicity of the nasopharyngeal flora

# Managing CSF leak

- Fracture reduction often stops leak
- Most traumatic leaks close spontaneously
- Leak > 72 hrs → lumbar drain
- Surgical repair
  - Endoscopic
  - intracranial