Resection margins in cancer surgery

Robert Baatenburg de Jong
Erasmus MC in context

- The Netherlands
  population: 16,000,000

- Rotterdam
  population: 600,000
  3 million

- Erasmus MC
  number of employees: 13,000
Erasmus MC

- Budget €1.2 billion
- 42,000 patients admitted
- 33,500 operations
- > 520,000 outpatients
Education

Students
- Medicine
- Nanobiology
- Clinical Technology

Research Masters / PhD
- Research Masters
  * Clinical Epidemiology
  * Clinical Research
  * Infection & Immunity
  * Molecular medicine
  * Neurosciences
- PhD programs
Fundamental and clinical research

- Five Research Schools
  - Cardiovascular Research School (COEUR)
  - Medical Genetic Center South-west Netherlands (MGC)
  - Molecular Medicine (MolMed)
  - The Netherlands Institute for Health Sciences (Nihes)
  - Neurosciences

- Medical Delta (EUR/Erasmus MC, Delft University of Technology, Leiden University (Medical Center))

- 220 PhDs’/yr

- 10,535 scientific publications (2006 - 2011)
New building

- In the center of Rotterdam
- Thematic layout
- Single-bed patient rooms
- Completion in 2017
ENT and H&N Surgery ErasmusMC

- **Long stay beds:** 20
- **Short stay beds:** 18
- **Outpatient clinics:** 63 per week
- **Outpatients:** 25,000 per year
- **HNSCC:** 650
- **Ablative surgery:** >300
Future of Surgery ErasmusMC

Innovation

1. Technical innovation
   - Optical Image Guided Surgery
     * Fluorescence
     * Spectroscopy
     * Raman
   - Clinical use of predictive and prognostic models
   - Tissue engineering

2. Safety and outcome

3. Postoperative pain

Organisation

- Close cooperation with non-academic hospitals in the region

Education

- Close cooperation with non-academic hospitals in the region
- Extensive use of skills lab
- Improvement of peri-operative care
- Dedicated protocols for each surgery
Future of Surgery
Optical Image Guided Surgery

- Why here? Why now?
  - Fluorescence in cooperation with Clemens Lowik
  - Spectroscopy (Dominic Robinson)
  - Raman (Gerwin Puppels)
  - ..
  - ..
Head and Neck Cancer

- Incidence >650,000 worldwide, and increasing*

Most often:
- Squamous cell carcinoma
- Oral cavity and pharynx

Risk factors include:
- Tobacco and alcohol (>75%)
- HPV
- Betel nut chewing

*http://www.cancer.gov
Head and Neck Cancer

- **Head and Neck**: upper aerodigestive tract, speech, all our senses, esthetics, very complex anatomy with important nerves and vessels

- **Cancer**:  
  - Pre-cancerous lesions  
  - Field cancerization  
  - Second primary tumors  
  - Local recurrences
First presentation
First presentation
Estimate size and growth pattern

- Palpation
- Estimate diameter
- CT/MRI
Treatment

- Local excision

- Oncological safe resection
- Tumor <-> resection borders > 10 mm
Histopathological results
Histopathological results

mucosa

tumour

muscle

tumour in resection margin

close margins < 5 mm
Histopathological results

- Close margins: 45% of cases
- Positive margins: 40% of cases
- 85% inadequate margins!
How bad is it? How bad are we?

- How bad are positive margins?
  - Local recurrence
  - Increased metastasis
  - Decreased survival


- How bad are we?
  - Review
Review by Roeland Smits

- Medline: n=404
- Cochrane: n=1
- Embase: n=589

Screening title/abstract

Inclusion criteria:
- OCSCC
- Treated after 1990

Exclusion criteria:
- Neoadjuvant treatment
- Non human study
- Not treated with surgery

n=994

Excluding Duplicates
n=679

n=18

Exclusion after reading full text:
- Results not applicable for our question
n=8
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Discussion (1)

- Striking difference in total inadequate margins when comparing literature results with our own retrospective study

- However: oncological results comparable!

  handling/preparation of the specimen?
  interpretation?
  communication?
Discussion (2)

- Inadequate histopathological margins
  - Poorer survival, more adjuvant therapy, more local recurrence and more metastasis

- Room for improvement:
  - Close cooperation between surgery and pathology
  - Real-time characterization of tumor and margins:

Optical Image Guided Surgery: OIGS
OIGS: Raman

- Local excision

- *In vivo* measurements of resection borders, either in patient or on resection specimen
OIGS: Reflectance spectroscopy

Optical Properties

- Absorption
  - Physiology
    - Blood volume
    - Saturation
    - Vessel diameter
    - cytochrome c
    - Bilirubin
    - beta-carotene
    - Lipids
    - Water

- Scattering
  - Architecture
    - Scattering coefficient
    - Tissue Ultrastructure
OIGS: Fluorescence

- Optical properties of tissues
  - Auto-fluorescence
  - Targeted fluorophores
- Near infrared camera
Impact of inadequate margins: other fields

The Actual Value of the Surgical Margin Status as a Predictor of Disease Progression in Men with Early Prostate Cancer

André N. Visa, Fritz H. Schröderb, Theodorus H. van der Kwastb

aDepartment of Urology, Erasmus Medical Center, Rotterdam, The Netherlands
bDepartment of Pathology and Laboratory Medicine, Mount Sinai Hospital, Toronto, Ontario, Canada

Surgical Margins for Resection of Primary Cutaneous Melanoma

JOEL COOK, MD

Influence of Surgical Margins on the Outcome of Breast Cancer Patients: A Retrospective Analysis

Sergio Bernardi · Serena Bertozzi · Ambrogio P. Londero · Giuliana Gentile · Vito Angione · Roberto Petri

The British Journal of Radiology. 84 (2011), S159–S167

Imaging biomarkers of brain tumour margin and tumour invasion

1S J PRICE, PhD, FRCS(NEURO.SURG) and 2J H GILLARD, MD, FRCR

1Academic Neurosurgery Division, Department of Clinical Neuroscience, and 2University Department of Radiology, Addenbrooke’s Hospital, Cambridge, UK
Purpose workshop

- Bring technicians, physicians and industry together
Effect on clinical outcome, EMC

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