

# BJS



---

Abstracts of the 106<sup>th</sup> Annual Congress of  
the Swiss Society of Surgery,  
held in Berne, Switzerland,  
15 May – 17 May 2019

# BJS

May 2019 Volume 106 Supplement 4

Abstracts of the 106<sup>th</sup> Annual Congress of  
the Swiss Society of Surgery, held in Berne,  
Switzerland, 15 May - 17 May 2019

## Disclaimer

This abstract book has been produced using author-supplied copy. Editing has been restricted to some corrections of spelling and style where appropriate. The publisher assumes no responsibility for any claims, instructions, methods or drug dosages contained in the abstracts. It is recommended that these are verified independently.

The contents contained herein are correct at the time of printing and may be subject to change.

**WILEY**  
Blackwell

# BJS

Incorporating *European Journal of Surgery* and *Swiss Surgery*

A Journal formed by the union of *BJS*, *Acta Chirurgica Scandinavica*, publisher of *European Journal of Surgery*, and the Swiss Society of Surgery, publisher of *Swiss Surgery*.

The Journal is specially related to the Association of Surgeons of Great Britain and Ireland, Spanish Society of Surgical Research, Swedish Surgical Society and Swiss Society of Surgery.

## Editorial Team

### Editor-in-Chief

J. J. Earnshaw, *Gloucester, UK*

### Editors

J. Beynon, *Swansea, UK*

C. H. C. Dejong, *Maastricht, The Netherlands*

M. D. Evans, *Swansea, UK*

R. J. Hinchliffe, *Bristol, UK*

K. Soreide, *Stavanger, Norway*

M. Sund, *Umeå, Sweden*

B. P. L. Wijnhoven, *Rotterdam, The Netherlands*

D. C. Winter, *Dublin, Ireland*

### Statistical Editors

J. A. Cook, *Oxford, UK*

J. Ranstam, *Lund, Sweden*

## Council

### Chairman

O. J. Garden, *Edinburgh, UK*

### Treasurer

M. G. Wyatt, *Newcastle upon Tyne, UK*

### Vice-Chairmen

A. Bergenfelz, *Lund, Sweden*

S. Post, *Mannheim, Germany*

### Company Secretary

J. Mayol, *Madrid, Spain*

R. J. Baigrie, *Capetown, South Africa*

J. Balibrea, *Barcelona, Spain*

M. Besseling, *Amsterdam, The Netherlands*

J. M. Blazeby, *Bristol, UK*

S. Breitenstein, *Zurich, Switzerland*

C. Bruns, *Cologne, Germany*

G. Carlson, *Manchester, UK*

N. Demartines, *Lausanne, Switzerland*

J. De Oca, *Barcelona, Spain*

O. Farges, *Paris, France*

C. Jönsson, *Gothenburg, Sweden*

P. B. S. Lai, *Hong Kong*

A. Montgomery, *Malmö, Sweden*

V. Papalois, *London, UK*

M. Sarr, *Rochester, Minnesota, USA*

D. Scott-Coombes, *Cardiff, UK*

S. Wigmore, *Edinburgh, UK*

## Editorial Board

E. Angenete, *Sweden*

M. Barczynski, *Poland*

D. Bartsch, *Germany*

G. Beets, *The Netherlands*

G. Belli, *Italy*

S. Biondo, *Spain*

M. Björck, *Sweden*

M. Bown, *UK*

J. Brockmann, *Switzerland*

C. Buskens, *The Netherlands*

D. Candinas, *Switzerland*

T. Carrel, *Switzerland*

D. Cherqui, *France*

S. Connor, *New Zealand*

A. de Beaux, *UK*

S. di Saverio, *Italy*

F. Dick, *Switzerland*

D. Doll, *Germany*

J. Fawcett, *Australia*

C. Ferrone, *USA*

D. Flum, *USA*

P. J. Friend, *UK*

I. Garcia-Alonso, *Spain*

T. Grantcharov, *Canada*

N. Hiki, *Japan*

J. Hill, *UK*

J. Holcomb, *USA*

M. Iacobone, *Italy*

J. Izbicki, *Germany*

S. Ko, *Japan*

H. Körner, *Norway*

K. Lassen, *Norway*

J. Laukkanen, *Finland*

A. Leppäniemi, *Finland*

P. Losty, *UK*

M. Makuuchi, *Japan*

J. Manjer, *Sweden*

J. McK. Manson, *UK*

W. Marti, *Switzerland*

A. Martling, *Sweden*

R. Morgan, *UK*

D. Morton, *UK*

R. Parks, *UK*

T. Pawlik, *USA*

M. Pera, *Spain*

X. Rogiers, *Belgium*

I. Schipper, *The Netherlands*

A. Siriwardena, *UK*

B. M. Smithers, *Australia*

A. Tuchmann, *Austria*

J. van Lanschot, *The Netherlands*

C. Vollmer, *USA*

D. Watson, *Australia*

T. Weiser, *UK*

J. Windsor, *New Zealand*

While every effort is made by the Editorial Team, members of the Council and the publishers to avoid inaccurate or misleading information appearing in *BJS*, data within the individual articles and advertisements are the responsibility of the authors or advertisers concerned. The *BJS* Society, the publishers and members of the Editorial Team and Council accept no liability whatsoever for the consequences of any such inaccurate or misleading data, opinion or statement. In addition, the acceptance of an advertisement to appear in *BJS* does not constitute a guarantee or endorsement by the *BJS* Society or the publisher of the quality or value of the advertised products or services or of the claims made for them by their advertisers.

## Editorial Office Managing Editor

Alison Cherie  
BJS, John Wiley & Sons Ltd  
100 West George Street, Glasgow G2 1PP, UK  
E-mail: alison.cherie@wiley.com

## Aims and Scope

*BJS* is the premier surgical journal in Europe and one of the top surgical periodicals in the world. Its international readership is reflected in the prestigious International Editorial Board, supported by a panel of over 1200 reviewers worldwide.

*BJS* features the very best in clinical and laboratory-based research on all aspects of general surgery and related topics. Developing areas such as minimally invasive therapy and interventional radiology are strongly represented.

The inclusion of Leading Articles, Reviews and Original Articles means that *BJS* offers an appropriate format for any length or type of submission; in addition, there are abstracts from key meetings and correspondence.

*BJS* will be of interest not only to general surgeons, but also to specialty surgeons and those working in related fields.

## Information for subscribers

The *BJS* is published in 12 issues per year. Subscription prices for 2019 are:

Institutional:

Print only EUR€977/GBP£669/US\$999

Online only EUR€977/GBP£669/US\$999

Print and online EUR€1222/GBP£837/US\$1249

Prices are exclusive of tax. Asia-Pacific GST, Canadian GST/HST and European VAT will be applied at the appropriate rates. For more information on current tax rates, please go to <https://onlinelibrary.wiley.com/library-info/products/price-lists/> payment. The price includes online access to the current and all online backfiles to January 1<sup>st</sup> 2015, where available. For other pricing options, including access information and terms and conditions, please visit <https://onlinelibrary.wiley.com/library-info/products/price-lists/>.

Terms of use can be found here: <https://onlinelibrary.wiley.com/terms-and-conditions>

For submission instructions, subscription and all other information visit: [wileyonlinelibrary.com/journal/bjs](http://wileyonlinelibrary.com/journal/bjs)

*BJS* accepts articles for Open Access publication. Please visit <https://authorservices.wiley.com/author-resources/Journal-Authors/open-access/onlineopen.html> for further information about OnlineOpen.

## Delivery Terms and Legal Title

Where the subscription price includes print issues and delivery is to the recipient's address, delivery terms are **Delivered at Place (DAP)**; the recipient is responsible for paying any import duty or taxes. Title to all issues transfers Free of Board (FOB) our shipping point, freight prepaid. We will endeavour to fulfil claims for missing or damaged copies within six months of publication, within our reasonable discretion and subject to availability.

**Back issues:** Single issues from current and recent volumes are available at the current single issue price from [cs-journals@wiley.com](mailto:cs-journals@wiley.com). Earlier issues may be obtained from Periodicals Service Company, 351 Fairview Avenue - Ste 300, Hudson, NY 12534, USA. Tel.: +1 518 822-9300, Fax: +1 518 822-9305. Email: [psc@periodicals.com](mailto:psc@periodicals.com)

## Contact Details

*BJS* is published by John Wiley & Sons Ltd.

**Journal Customer Services:** For ordering information, claims and any enquiry concerning your journal subscription please go to <https://hub.wiley.com/community/support/onlinelibrary> or contact your nearest office.

**Americas:** Email: [cs-journals@wiley.com](mailto:cs-journals@wiley.com); Tel.: +1 781 388 8598 or +1 800 835 6770 (toll free in the USA & Canada).

**Europe, Middle East and Africa:** Email: [cs-journals@wiley.com](mailto:cs-journals@wiley.com); Tel.: +44 (0) 1865 778315.

**Asia Pacific:** Email: [cs-journals@wiley.com](mailto:cs-journals@wiley.com); Tel.: +65 6511 8000.

**Japan:** For Japanese speaking support, Email: [cs-japan@wiley.com](mailto:cs-japan@wiley.com).

**Visit our Online Customer Help** available in 7 languages at <https://hub.wiley.com/community/support/onlinelibrary>

## Advertising

Sarah Young, Advertising Coordinator  
Tel.: +44 (0)1865 476363  
E-mail: [sarah.young@wiley.com](mailto:sarah.young@wiley.com)

## Commercial Reprints

E-mail: [corporatesaleseurope@wiley.com](mailto:corporatesaleseurope@wiley.com); [corporatesalesusa@wiley.com](mailto:corporatesalesusa@wiley.com); or [corporatesalesaustralia@wiley.com](mailto:corporatesalesaustralia@wiley.com)

## Author Reprints

Order online: [www.sheridan.com/wiley/eoc](http://www.sheridan.com/wiley/eoc)

## Production Editor

For manuscripts that have been accepted for publication, please contact:

Tanya Kneller

E-mail: [tknelle2@wiley.com](mailto:tknelle2@wiley.com)

## Copyright and Copying (in any format)

Copyright © 2019 BJS Society Ltd. All rights reserved. No part of this publication may be reproduced, stored or transmitted in any form or by any means without the prior permission in writing from the copyright holder. Authorization to copy items for internal and personal use is granted by the copyright holder for libraries and other users registered with their local Reproduction Rights Organisation (RRO), e.g. Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923, USA ([www.copyright.com](http://www.copyright.com)), provided the appropriate fee is paid directly to the RRO. This consent does not extend to other kinds of copying such as copying for general distribution, for advertising or promotional purposes, for republication, for creating new collective works or for resale. Permissions for such reuse can be obtained using the RightsLink "Request Permissions" link on Wiley Online Library. Special requests should be addressed to: [permissions@wiley.com](mailto:permissions@wiley.com)

## Disclaimer

The Publisher, BJS Society Ltd and Editors cannot be held responsible for errors or any consequences arising from the use of information contained in this journal; the views and opinions expressed do not necessarily reflect those of the Publisher, BJS Society Ltd and Editors, neither does the publication of advertisements constitute any endorsement by the Publisher, BJS Society Ltd and Editors of the products advertised.

## Note to NIH Grantees

Pursuant to NIH mandate, Wiley-Blackwell will post the accepted version of contributions authored by NIH grant-holders to PubMed Central upon acceptance. This accepted version will be made publicly available 12 months after publication. For further information, see [www.wiley.com/go/nihmandate](http://www.wiley.com/go/nihmandate).

## Periodical ID Statement

*BJS* (Print ISSN 0007-1323 Online ISSN 1365-2168) is published monthly. US mailing agent: Mercury Media Processing, LLC, 1850 Elizabeth Avenue, Suite #C, Rahway, NJ 07065, USA. Periodical postage paid at Rahway, NJ, USA.

Postmaster: send all address changes to *BJS*, John Wiley & Sons Inc., C/O The Sheridan Press, PO Box 465, Hanover, PA 17331, USA.

Wiley's Corporate Citizenship initiative seeks to address the environmental, social, economic, and ethical challenges faced in our business and which are important to our diverse stakeholder groups. Since launching the initiative, we have focused on sharing our content with those in need, enhancing community philanthropy, reducing our carbon impact, creating global guidelines and best practices for paper use, establishing a vendor code of ethics, and engaging our colleagues and other stakeholders in our efforts. Follow our progress at [www.wiley.com/go/citizenship](http://www.wiley.com/go/citizenship)

ISSN 0007-1323 (Print)

ISSN 1365-2168 (Online)

View this journal online at [wileyonlinelibrary.com/journal/bjs](http://wileyonlinelibrary.com/journal/bjs)

The Journal is indexed by Science Citation Index & Web of Science, MEDLINE/PubMed and Scopus. Please visit the journal website for a full list of A&I services.

Wiley is a founding member of the UN-backed HINARI, AGORA, and OARE initiatives. They are now collectively known as Research4Life, making online scientific content available free or at nominal cost to researchers in developing countries. Please visit Wiley's Content Access - Corporate Citizenship site: <http://www.wiley.com/WileyCDA/Section/id-390082.html>

Printed in Singapore by C.O.S. Printers Pte Ltd.

# BJs

Volume 106, Supplement 4, May 2019

5	<b>Bariatry and hernias</b>
7	<b>Basic research</b>
10	<b>Hand</b>
10	<b>Hepato-pancreatobiliary</b>
13	<b>Lower gastrointestinal tract</b>
19	<b>Thorax</b>
22	<b>Traumatology</b>
24	<b>Upper gastrointestinal tract</b>
25	<b>Vessel</b>

# Swiss Society of Surgery

The following abstracts will be presented at the 106<sup>th</sup> Annual Congress of the Swiss Society of Surgery, held in Berne, Switzerland, 15 May - 17 May 2019.

## Bariatry and hernias

### Defining global benchmarks in bariatric surgery. A multicenter analysis of minimally invasive Roux-en-Y gastric bypass and sleeve gastrectomy

D. Gero<sup>1</sup>, D. A. Raptis<sup>2</sup>, W. Vleeschouwers<sup>3</sup>, S. L. van Veldhuisen<sup>4</sup>, A. San Martin<sup>5</sup>, Y. Xiao<sup>6</sup>, M. Galvao<sup>7</sup>, M. Giorgi<sup>8</sup>, M. Benois<sup>9</sup>, F. Espinoza<sup>10</sup>, M. Hollyman<sup>11</sup>, A. Lloyd<sup>12</sup>, H. Hosa<sup>1</sup>, H. Schmidt<sup>1</sup>, J. L. Garcia-Galocha<sup>13</sup>, S. Van de Vrande<sup>14</sup>, S. Chiappetta<sup>15</sup>, E. Lo Menzo<sup>16</sup>, C. Mamédio Aboud<sup>17</sup>, S. Gagliardo Lüthy<sup>18</sup>, P. Orchard<sup>19</sup>, S. Rothe<sup>20</sup>, G. Prager<sup>20</sup>, D. J. Pournaras<sup>19</sup>, R. Cohen<sup>17</sup>, R. Rosenthal<sup>16</sup>, R. Weiner<sup>15</sup>, J. Himpens<sup>14</sup>, A. Torres<sup>13</sup>, K. Higa<sup>12</sup>, R. Welbourn<sup>11</sup>, M. Berry<sup>10</sup>, C. Boza<sup>10</sup>, A. Iannelli<sup>9</sup>, S. Vithiananthan<sup>8</sup>, R. Almino<sup>7</sup>, T. Olbers<sup>6</sup>, M. Sepulveda<sup>5</sup>, E. J. Hazebroek<sup>4</sup>, B. Dillemans<sup>3</sup>, R. D. Staiger<sup>1</sup>, M. A. Puhan<sup>21</sup>, R. Peterli<sup>18</sup>, M. Bueter<sup>1</sup>

<sup>1</sup>Department of Surgery, University Hospital Zurich, Zurich, Switzerland,

<sup>2</sup>Department of Liver Transplantation, Royal Free Hospital, London, United Kingdom,

<sup>3</sup>Department of General Surgery, AZ Sint Jan Brugge-Oostende, Brugge-Oostende, Belgium,

<sup>4</sup>Department of Surgery, Rijnstate Hospital/Vitalys Clinics, Arnhem, Netherlands,

<sup>5</sup>Bariatric and Metabolic Surgery Center, Dipreca Hospital, Las Condes, Chile,

<sup>6</sup>Department of Surgery, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden,

<sup>7</sup>Gastro-Obeso-Center, Advanced Institute in Bariatric and Metabolic Surgery, Sao Paulo, Brazil,

<sup>8</sup>Department of Surgery, Alpert Medical School of Brown University -The Miriam Hospital, Providence, USA,

<sup>9</sup>Digestive Surgery and Liver Transplantation Unit, University Côte d'Azur, Nice, France,

<sup>10</sup>Department of Surgery, Bariatric and Metabolic Center, Clinica Las Condes, Las Condes, Chile,

<sup>11</sup>Department of Upper Gastrointestinal and Bariatric Surgery, Musgrove Park Hospital, Taunton, United Kingdom,

<sup>12</sup>Minimally Invasive and Bariatric Surgery, Fresno Heart and Surgical Hospital, Fresno, USA,

<sup>13</sup>Department of Surgery, Hospital Clínico San Carlos, Complutense University of Madrid, Madrid, Spain,

<sup>14</sup>Department of General Surgery, AZ Sint-Blasius Hospital, Dendermonde, Belgium,

<sup>15</sup>Department of Obesity and Metabolic Surgery, Sana Clinic Offenbach, Offenbach, Germany,

<sup>16</sup>The Bariatric and Metabolic Institute, Cleveland Clinic Florida, Weston, USA,

<sup>17</sup>Center for the treatment of Obesity and Diabetes, Hospital Oswaldo Cruz, Sao Paulo, Brazil,

<sup>18</sup>Department of Surgery, St. Claraspital, Basel, Switzerland,

<sup>19</sup>North Bristol Centre for Weight Loss Metabolic and Bariatric Surgery, Southmead Hospital, Bristol, United Kingdom,

<sup>20</sup>Department of Surgery, University Hospital of Vienna, Vienna, Austria,

<sup>21</sup>Epidemiology, Biostatistics and Prevention Institute, University of Zurich, Zurich, Switzerland

**Objective:** Benchmarking uses best performance in a given field as reference point for others to improve. Surgical benchmarks – best achievable results – were recently introduced in outcome research. Our aim was to identify the global benchmarks for bariatric surgery (BS) (Roux-en-Y gastric bypass [RYGB] and sleeve gastrectomy [SG]).

**Methods:** The establishment of BS benchmarks followed a standardized methodology, previously applied for liver surgery and esophagectomy. Out of 39424 elective bariatric procedures performed in 19 high volume academic centers on 3 continents between 06/2012–05/2017, we identified 4120 RYGB and 1457 SG benchmark cases based on preoperative risk-factors (Fig. 1). Benchmark patients had no: previous abdominal surgery, concomitant procedures, diabetes, sleep apnea, cardiopathy, renal insufficiency, IBD, immunosuppression, anti-coagulation, BMI > 50kg/m<sup>2</sup>, age > 65 years and were followed-up for minimum 90-days. We chose clinically relevant endpoints covering intra- and postoperative course, with a focus on complications graded by

severity, using the Clavien-Dindo classification and the comprehensive complication index (CCI®). Benchmark cut-offs were set at the 75<sup>th</sup> percentile of the included centers' median value for respective outcomes (R software).

**Results:** BS patients were mainly females (78%), aged 38 ± 11 years, with a baseline BMI of 40.8 ± 5.8 kg/m<sup>2</sup>. Benchmark cutoffs for surgical quality indicators are presented in Table 1 for RYGB, and in Table 2 for SG. During the first 90-days, 7.2% of RYGB and 6.2% of SG patients presented at least 1 complication. For RYGB and SG alike, most readmissions occurred beyond 90-days (Fig. 2), and were most frequently due to symptomatic cholelithiasis or abdominal pain of unknown origin (Fig. 3).

**Conclusion:** Benchmark cutoffs targeting peri-operative outcomes in BS offer a new tool in surgical quality-metrics and may be implemented in the quality-improvement cycle. In high-volume centers, the 90-day postoperative morbidity of BS in low-risk patients is remarkably low and the mortality is zero. However, re-interventions increase with time after surgery and may not entirely depend on baseline patient factors or surgical performance (i.e.: abdominal pain of unknown origin or weight-loss induced cholelithiasis). This emphasizes the need for BS centers to show commitment to long-term follow-up of bariatric patients.

### Development and validation of a prediction model for internal hernia after Roux-en-Y gastric bypass.

G. Giudicelli<sup>1</sup>, C. Toso<sup>2</sup>, P. Morel<sup>2</sup>, S. P. Mönig<sup>2</sup>, M. E. Hagen<sup>2</sup>, M. Vix<sup>3</sup>, M. Diana<sup>3</sup>, A. Lapergola<sup>3</sup>, M. Worreth<sup>1</sup>, A. Saadi<sup>1</sup>, A. Buman<sup>1</sup>, A. Platon<sup>4</sup>, P. A. Poletti<sup>4</sup>, M. K. Jung<sup>2</sup>

<sup>1</sup>Department of Surgery, Hospital of Neuchâtel, Neuchâtel, Switzerland,

<sup>2</sup>Department of Visceral Surgery, Geneva University Hospitals, Geneva, Switzerland,

<sup>3</sup>Department of Surgery, Strasbourg University Hospital, Strasbourg, France,

<sup>4</sup>Department of Radiology, Geneva University Hospitals, Geneva, Switzerland

**Objective:** Diagnosis of internal hernia (IH) after Roux-en-Y gastric bypass (RYGB) is challenging. Sensitivity of 63-92% was reported for computer tomography (CT). Laparoscopy remains paramount but yields surgical morbidity. We aimed to evaluate clinical and radiological signs of IH to develop and validate a prediction score.

**Methods:** Consecutive patients admitted for abdominal pain after RYGB which underwent CT and surgical exploration were retrospectively included. Patients with appendicitis or CT unavailable for review were excluded. Binary logistic regression was used to determine a predictive score of surgically confirmed IH on Geneva training set (January 2006 - December 2014) which was validated in three tertiary centres Geneva (January 2015 - December 2017), Neuchâtel (January 2012 - December 2017) and Strasbourg (January 2012 - December 2017).

**Results:** 228 patients were included, 80 (35.5%) had surgically confirmed IH, 38 (16.6%) had negative laparoscopy, 110 (48.2%) had an alternate diagnosis. In the training set of 61 patients, excess body weight loss > 95% (OR 6.73 [95% CI, 1.13-39.96]), swirl sign (OR 8.93 [95% CI, 2.30-34.70]), and free liquid in one quadrant (OR 4.53 [95% CI, 1.08-19.0]) were independent predictors of IH. Equal point value of 1 was assigned to each predictor, C-statistic was 0.799. In the validation set of 167 patients, IH-score ≥ 2 was associated with an incidence of IH of 60.7% (34/56) and 5.3% (3/56) had negative laparoscopy, C-statistic was 0.846.

**Conclusion:** IH-score showed good performance and could be incorporated in a clinical setting. We would recommend explorative laparoscopy in patients with a score ≥ 2.

### Early outcome in patients with non - alcoholic fatty liver in comparison with patients with non - alcoholic steatohepatitis undergoing gastric bypass - a propensity score matched analysis

Z. Abbassi, S. D. Sgardello, S. P. Naïken, N. Niclauss, M. Chevally, S. P. Mönig, C. Toso, M. E. Hagen, M. K. Jung

*Divisions of Abdominal Surgery, Geneva University Hospitals, Geneva, Switzerland*

**Objective:** Incidence of non-alcoholic steatohepatitis (NASH) in the obese population is reported up to 10-20% and postoperative weight loss as well as metabolic outcome after Roux-en-Y gastric bypass (RYGB) may be impaired in these patients. In the present study we compare postoperative glycemic control, liver function and weight loss in two groups of patients with non-alcoholic fatty liver (NAFL) and NASH who underwent RYGB.

**Methods:** We retrospectively evaluated 517 patients undergoing RYGB with concomitant liver biopsy between 1997 and 2013. Clinical follow up was performed at 12 months after surgery. Furthermore, we performed a propensity score matching (PSM) 1:1 on age, sex, BMI and incidence of diabetes.

**Results:** Within the entire cohort, at baseline before matching, the NAFL (n=422) and NASH (n=95) groups were comparable in age, body mass index (BMI), ASA score and sex ratio whereas the incidence of diabetes differed significantly (23% vs 47%;  $p < 0,001$ ).

At baseline the NAFL group had significantly lower glycemia ( $6,3 \pm 2$  vs  $7,9 \pm 3,5$ ;  $p < 0,001$ ), insulinemia ( $24,1 \pm 15,2$  vs  $41,8 \pm 45,1$ ;  $p < 0,001$ ), aspartate aminotransferase (ASAT) ( $21,8 \pm 11,8$  vs  $38 \pm 28,9$ ;  $p < 0,001$ ) and alanine aminotransferase (ALAT) ( $31,8 \pm 25,1$  vs  $61,1 \pm 46,8$ ;  $p < 0,001$ ). The homeostasis model assessment insulin resistance (HOMA-IR) was significantly lower in the NAFL group ( $6,2 \pm 5,7$  vs  $11,9 \pm 13,9$ ;  $p < 0,001$ ). At the one year follow up of the entire cohort, the two groups were comparable in BMI, percentage excess weight loss (EWL) ( $70,79 \pm 21\%$  vs  $78,16 \pm 20\%$ ), ASAT, ALAT. Glycemia ( $4,8 \pm 1$  vs  $5,2 \pm 1,4$ ;  $p = 0,045$ ), insulinemia ( $24,1 \pm 15,2$  vs  $41,8 \pm 45,1$ ;  $p = 0,001$ ) and HOMA-IR ( $2,3 \pm 1$  vs  $1,6 \pm 1,15$ ;  $p = 0,001$ ) were significantly higher in the NASH group. At Baseline, the PSM analysis of 56 patients in each group and showed us a significantly lower ASAT ( $23,5 \pm 15,4$  vs  $33,35 \pm 21,5$ ;  $p = 0,007$ ), ALAT ( $34,3 \pm 22,7$  vs  $55,2 \pm 35,8$ ;  $p < 0,001$ ) in the NAFL group. But after 1 year, the PSM demonstrated similar EWL, liver enzymes, glycemia and HOMA-IR, whereas the insulinemia ( $7,9 \pm 4,2$  vs  $10,2 \pm 4,3$ ;  $p = 0,04$ ) differed significantly between the groups.

**Conclusion:** Patients with NASH seem to improve their liver function after gastric bypass and show comparable weight loss in comparison with patients with NAFL. Meanwhile, glycemic control seems to be compromised in patients with NASH after gastric bypass in comparison with NAFL even in well-matched obese patients.

### Impact of Roux-en-Y gastric bypass alimentary limb length on long-term weight loss, diabetes, and dumping syndrome outcomes

C. Tsai<sup>1</sup>, J. Zehetner<sup>1</sup>, L. Bally<sup>2</sup>, R. Steffen<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Hirslanden Hospital Beau-Site, Bern, Switzerland, <sup>2</sup>Department of Endocrinology, Inselspital, University Hospital of Bern, Bern, Switzerland

**Objective:** Roux-en-Y gastric bypass (RYGB) is the most commonly performed surgery for morbidly obese patients worldwide. Consensus is still lacking on whether a short or long alimentary limb is superior regarding weight loss, comorbidity resolution, and complications. The aim of this study was to compare the long-term outcomes after short alimentary limb (SAL) and long alimentary limb (LAL) RYGB.

**Methods:** Morbidly obese patients were randomized to receive either a short alimentary limb (80cm) or long alimentary limb (250cm) RYGB at a single institution in Bern, Switzerland in 2003. Patients were followed up annually in an outpatient bariatric center, and those who completed a minimum of 10 years' follow-up were included in this study. Patients' medical records were reviewed and analyzed for complications, weight loss outcomes, comorbidity resolution, and development of dumping syndrome.

**Results:** A total of 41 patients were randomized to the SAL group and 46 patients to the LAL group. There were no differences in baseline body mass index (BMI), age, gender, nor rate of comorbidities (diabetes, hypertension, hyperlipidemia) between the two groups. Sufficient follow-up was available

for 70.7% of the SAL group and 84.8% of the LAL group. Mean follow-up time for the SAL group was 14.2 years (R12-15) and 13.8 years (R10-15) for the LAL group. There were no differences in rates of leak, infection, nor bleeding between the two groups. At most recent follow-up, mean excess weight loss (EWL) was 66.8% (R37.4-96.9) for the SAL group and 64.4% (R33.5-93.3) in the LAL group ( $p = 0,84$ ). The rate of comorbidity resolution was similar between the two groups. Specifically, 38.5% of diabetes cases resolved in the SAL group and 50% resolved in the LAL group ( $p = 0,71$ ). There were no differences in development of dumping syndrome between the two groups (19.2% vs 10%, SAL vs LAL, respectively,  $p = 0,45$ ). One patient from the SAL group died from cancer. Otherwise, no deaths were recorded.

**Conclusion:** Alimentary limb length does not influence long-term outcomes after RYGB. Weight loss outcomes and comorbidity control between SAL RYGB and LAL RYGB are similar. Limb length does not affect the rate of developing dumping syndrome.

167 → Abstract wurde zurückgezogen

### Mid-term follow-up after laparoscopic revision of gastric bypass for weight loss failure with an adjustable gastric band

I. Lazaridis<sup>1</sup>, M. Kraljevic<sup>1</sup>, T. Köstler<sup>2</sup>, U. Zingg<sup>2</sup>, T. Delko<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Clarunis - University Abdominal Center, Basel, Switzerland, <sup>2</sup>Department of General Surgery, Limmattal Hospital, Schlieren, Switzerland

**Objective:** Although laparoscopic Roux-en-Y gastric bypass (LRYGB) is widely accepted as treatment of obesity and its comorbidities, between 20-40% of patients fail to achieve satisfactory long-term weight loss. Several surgical revisional techniques have been introduced to manage failed LRYGB. However, at present, standardized algorithms for revision for weight loss failure are still lacking. The aim of this study is to review the safety and efficacy of laparoscopic adjustable gastric banding (LAGB) as a revisional procedure after LRYGB due to weight regain or failed weight loss in a single institution.

**Methods:** We conducted a retrospective review of the data of all patients who underwent secondary LAGB with the Minimizer Extra® gastric band after proximal or distal LRYGB between 2011 and 2014 in our institution. The primary outcome was weight loss. Secondary outcomes were morbidity and control of comorbidities.

**Results:** Twelve patients (n=12) were treated with LAGB during the study period. The mean body mass index (BMI) before LRYGB was  $44,8 \pm 8$  kg/m<sup>2</sup>. Prerevisional mean BMI was  $35,0 \pm 3,5$  kg/m<sup>2</sup> with a  $40,4 \pm 14,9\%$  mean excess weight loss (EWL). After a mean follow-up of  $40,6 \pm 20,4$  months, the average BMI was  $29,4 \pm 7$  kg/m<sup>2</sup> with a mean additional EWL of  $28,6 \pm 25,4\%$  and total EWL of  $69,1 \pm 25,1\%$ . One patient required band removal because of slippage, two bands needed revision because of disconnection or dislocation and two bands needed re-fixation because of torsion of the alimentary limb. One patient received conversion into reversion LRYGB with a long biliopancreatic limb due to insufficient weight loss.

**Conclusion:** LAGB after failed LRYGB shows promising additional weight loss in the mid-term follow-up and therefore may be considered as a valuable option. However, patients must be advised about the high reoperation rate for technical band-related problems.

### Postoperative urinary retention after endoscopic total extraperitoneal inguinal hernia repair: a retrospective analysis in a single centre

S. Di Natale, J. Sliker, S. Soppe, U. Bieri, A. Keerl, A. Nocito

*Department of Surgery, Cantonal Hospital Baden, Baden, Switzerland*

**Objective:** Postoperative urinary retention (POUR) is a common complication after inguinal hernia repair with a reported incidence up to 20%. POUR may cause catheter-related infections or injuries, longer hospital stay and higher overall costs. Our primary aim was to assess the incidence of POUR after endoscopic total extraperitoneal (TEP) inguinal hernia repair at our institution, and identify risk factors.

**Methods:** We retrospectively analysed all patients included in a prospective Hernia Database who underwent a TEP inguinal hernia repair at our institution between July 2012 and May 2018. POUR was defined as the inability to urinate spontaneously after surgery requiring a bladder catheter. A univariate analysis was performed to identify risk factors of POUR.

**Results:** In total 1570 patients were included in the study. 65 patients developed POUR, corresponding to an incidence of 4.1%. Patients who developed POUR were significantly older (56 years vs. 71 years,  $p$ -value < 0.001), and had a higher American Society of Anesthesiologists (ASA) score (ASA-3 6% vs 20%,  $p$ -value < 0.001). Incidence of POUR was significantly increased in patients who previously underwent prostate surgery (3.9% vs 10.9%,  $p$ -value 0.020), patients undergoing a unilateral operation (1.9% vs 6.0%,  $p$ -value < 0.001), and patients who received an intraoperative drainage (2.1% vs 4.9%,  $p$ -value 0.001). Gender, body mass index, preoperative pain, emergency operation, operation time, or fixation-technique did not influence the risk of developing POUR. In patients who developed POUR the length of stay more often exceeded our standard 2 postoperative days (14.2% non-POUR vs 35.4% POUR,  $p$ -value < 0.001). Post-operative pain was not increased in patients with POUR.

**Conclusion:** Several high-risk patient categories were identified, and multivariate analysis and further prospective analysis based on high-risk patients are being performed. The influence of an intraoperative bladder catheter, which at our institute is often omitted for unilateral surgery, has to be investigated. Considering current efforts in Switzerland to increase outpatient inguinal hernia operations, the identification of high-risk patients of POUR is particularly important.

#### Smaller inguinal hernias are independent risk factors for developing Chronic Postoperative Inguinal Pain (CPIP): a registry - based multi-variable analysis of 57'999 patients

H. Hoffmann<sup>1,2</sup>, D. Walther<sup>3</sup>, R. Bittner<sup>4</sup>, F. Köckerling<sup>5</sup>, D. Adolf<sup>6</sup>, P. Kirchoff<sup>1,2</sup>

<sup>1</sup>ZweiChirurgen GmbH, Hernia Center, Basel, Switzerland, <sup>2</sup>Hernia Center, Hirslanden Hospital Birsbof, Münchenstein, Switzerland, <sup>3</sup>Department of Surgery, Hospital Hirslanden Salem, Bern, Switzerland, <sup>4</sup>Department of Surgery, Wingofer Medicum Hernia Center, Rottenburg am Neckar, Germany, <sup>5</sup>Department of Visceral and Vascular Surgery, Vivantes Hospital Berlin-Spandau, Berlin, Germany, <sup>6</sup>Biometrics and Data Management, Statconsult GmbH, Magdeburg, Germany

**Objective:** Impact of inguinal hernia defect size as stratified by the European Hernia Society (EHS) classification I to III on the rate of chronic postoperative inguinal pain (CPIP). BACKGROUND CPIP is the most important complication after inguinal hernia repair. The impact of hernia defect size according to the EHS classification on CPIP is unknown.

**Methods:** In total, 57,999 male patients from the Herniated registry undergoing primary unilateral inguinal hernia repair including a 1-year follow-up were selected between September 1, 2009 and November 30, 2016. Using multivariable analysis, the impact of EHS inguinal hernia classification (EHS I vs EHS II vs EHS III and/or scrotal) on developing CPIP was investigated.

**Results:** Multivariable analysis revealed for smaller inguinal hernias a significant higher rate of pain at rest [EHS I vs EHS II: odds ratio, OR = 1.350 (1.180-1.543),  $P$  < 0.001; EHS I vs EHS III and/or scrotal: OR = 1.839 (1.504-2.249),  $P$  < 0.001; EHS II vs EHS III and/or scrotal: OR = 1.363 (1.125-1.650),  $P$  = 0.002], pain on exertion [EHS I vs EHS II: OR = 1.342 (1.223-1.473),  $P$  < 0.001; EHS I vs EHS III and/or scrotal: OR = 2.002 (1.727-2.321),  $P$  < 0.001; EHS II vs EHS III and/or scrotal: OR = 1.492 (1.296; 1.717),  $P$  < 0.001], and pain requiring treatment [EHS I vs EHS II: OR = 1.594 (1.357-1.874),  $P$  < 0.001; EHS I vs EHS III and/or scrotal: OR = 2.254 (1.774-2.865),  $P$  < 0.001; EHS II vs EHS III and/or scrotal: OR = 1.414 (1.121-1.783),  $P$  = 0.003] at 1-year follow-up. Younger patients (< 55 y) revealed higher rates of pain at rest, pain on exertion, and pain requiring treatment (each  $P$  < 0.001) with a significantly trend toward higher rates of pain in smaller hernias.

**Conclusion:** Smaller inguinal hernias have been identified as an independent patient-related risk factor for developing CPIP.

## Basic research

#### Combination of neonatal porcine islets with mesenchymal stem cells of human and porcine origin improves islet function

C. Gonelle-Gispert<sup>1</sup>, A. Balaphas<sup>2</sup>, J. Meyer<sup>2</sup>, E. Montanari<sup>2</sup>, L. Szabo<sup>3</sup>, S. Gerber<sup>3</sup>, L. Bühler<sup>2</sup>

<sup>1</sup>Surgical Research Unit, Faculty of Medicine, University of Geneva, Geneva, Switzerland, <sup>2</sup>Surgical Research Unit - Visceral Surgery, Geneva University Hospitals, Geneva, Switzerland, <sup>3</sup>Institute of Chemical Sciences & Engineering, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

**Objective:** Neonatal porcine islets (NPIs) represent an unlimited source for islet xenotransplantation in type 1 Diabetes patients, despite limited function of neonatal tissue. We analyzed human bone marrow mesenchymal stem cells (hMSC) and pig exocrine tissue-derived MSC (pMSC) for their effects on islet function prior and after encapsulation.

**Methods:** Pancreases were recovered from neonatal pigs and NPIs isolated by slicing, collagenase digestion and culture for maturation. Maturation of NPI was followed by Immunofluorescence studies and insulin secretion assay. pMSC were expanded and characterized by FACS. Insulin secretion assays of NPI co-cultured and co-encapsulated with MSC from human and pigs were performed to analyze their functionality.

**Results:** Isolation of neonatal pancreases resulted in yields of  $340'000 \pm 160'000$  IEQ (obtained from 3 pancreases in 5 experiments). Immunofluorescence staining of NPIs revealed increasing insulin +  $\beta$ -cells between day 9 and 21 in culture. Insulin content of NPI increased progressively over time from  $27.8 \pm 11.47 \mu\text{g/l}$  to  $2466 \pm 637.9 \mu\text{g/l}$ , at days 3 and 14, respectively, for 500 IE,  $p$  < 0.001). Culture and expansion of adherent cells from the pig exocrine tissue resulted in a homogenous CD90+, CD34- and CD45-fibroblast-like population. Differentiation of these cells into adipocytes and chondrocytes showed their multipotency. Secretion assays showed an increased insulin release from NPIs only when these were in cell-cell contact with MSC (for hMSC fold increase:  $1.97 \pm 0.27$ , for pMSC fold increase :  $4.04 \pm 1.1$ ,  $p$  < 0.001) whereas without direct contact, insulin stimulation was not increased. Secretion assays performed on NPIs co-encapsulated with hMSC or pMSC in Ca2+-alginate microspheres after 3 days of encapsulation showed enhanced insulin secretion compared to NPIs encapsulated alone.

**Conclusion:** MSC of human and porcine origin significantly enhance insulin secretion of NPIs when co-cultured in direct contact. Encapsulation of NPIs with MSC should be considered for clinical application.

#### Fibrin-based transient delivery of engineered VEGF and PDGF-BB proteins ensures robust and stable angiogenesis in the skin of diabetic mice

P. Valente, A. Certelli, A. Uccelli, A. Grosso, N. Di Maggio, T. Wolff, L. Gürke, R. Gianni-Barrera, A. Banfi

Department of Vascular Surgery and Cell and Gene Therapy, University Hospital Basel, Basel, Switzerland

**Objective:** Here we aimed at establishing the angiogenic and arteriogenic potential of an optimized fibrin-based co-delivery of VEGF and PDGF-BB in a pre-clinical animal model of diabetic Skin.

**Methods:** 10-week old diabetic mice (BKS.Cg-Dock7m+/+Leprdb/J) received intracutaneous injections (in the dermal layer) of fibrin hydrogels (20  $\mu\text{l}$ ) containing VEGF alone (100  $\mu\text{g/ml}$ ) or together with PDGF-BB (10  $\mu\text{g/ml}$ ), or no factors as negative control (6 injections/animal;  $n$  = 6-9/condition and time-point). Tissues were harvested at 7- and 28-day time-points after intravascular perfusion of fixative (1% paraformaldehyde), frozen and cryosectioned. Vascular growth was imaged by immunofluorescence staining and confocal microscopy. The amount and size of induced vessels were quantified with the Olympus Cell Sense software.

**Results:** By 7 days fibrin was almost consumed. Both VEGF alone (V) or with PDGF-BB (VP) induced a comparable increase in vascular density (Vessel Length Density, VLD:  $V = 24,1 \pm 0,9 \text{ mm/mm}^2$ ;  $VP = 25,9 \pm 0,9 \text{ mm/mm}^2$ ; control =  $11,9 \pm 0,9 \text{ mm/mm}^2$ ;  $p$  < 0.0001). The total amount of induced vessels (vessel density multiplied by the total area of angiogenic effect) was also similar in V and VP tissues. However, V-induced new vessels were significantly

larger than those induced by VP ( $V = 11,7 \pm 0,77 \mu\text{m}$ ;  $VP = 8,9 \pm 0,72 \mu\text{m}$ ; control =  $5,6 \pm 0,34 \mu\text{m}$ ;  $p < 0,05$  V vs VP), confirming the ability of PDGF-BB to prevent aberrant vascular enlargement by high-dose VEGF. After 28 days fibrin was no longer detectable in any condition. Vessels induced by VEGF alone showed partial regression compared to 7 days (VLD  $V = 19,1 \pm 1,5 \text{ mm/mm}^2$ ), which was prevented by addition of PDGF-BB ( $VP = 23,6 \pm 1,1 \text{ mm/mm}^2$ ). Definitively remodeled vessels showed similar capillary-size diameters in all conditions by 28 days ( $V = 4 \pm 0,15 \mu\text{m}$ ;  $VP = 3,9 \pm 0,12 \mu\text{m}$ ; control =  $4,2 \pm 0,12 \mu\text{m}$ ;  $p$  n.s.), suggesting a preferential regression of the more aberrant structures induced by high-dose VEGF alone.

**Conclusion:** These results establish the feasibility of fibrin-based delivery of angiogenic factors in the skin of diabetic mice. Co-delivery of PDGF-BB both prevented aberrant angiogenesis and ensured persistence of new vessels despite transient factor delivery. Although spontaneous angiogenesis is impaired in diabetic mice, high-dose delivery of fibrin-bound VEGF and PDGF-BB was effective to induce robust growth of stable and physiological vascular networks.

#### Hypoxia sensing of hepatic stellate cells leads to VEGF-dependent angiogenesis to accelerate liver regeneration in ALPPS

K. Dirscherl<sup>1,2</sup>, B. Beck Schimmer<sup>1</sup>, M. Schläpfer<sup>2</sup>, R. Wenger<sup>1</sup>, D. Spahn<sup>2</sup>

<sup>1</sup>Institute of Physiology, University of Zurich, Zurich, Switzerland, <sup>2</sup>Institute of Anesthesiology, University Hospital Zurich, Zurich, Switzerland

**Objective:** Rerouting portal vein flow induces slow liver regeneration. Associating Liver Partition and portal vein ligation for staged hepatectomy (ALPPS) induces rapid regeneration by adding parenchymal transection to portal vein ligation (PVL). In ALPPS but not PVL, hypoxia inducible factor-1 $\alpha$  (HIF-1 $\alpha$ ) is upregulated in the liver and prolyl-hydroxylase inhibitors (PHI) also upregulate HIF-1 $\alpha$  and accelerate liver regeneration. This study aims to clarify the role of HIF-1 $\alpha$  in accelerating liver regeneration.

**Methods:** Rat models of PVL, ALPPS, PVL+PHI (Dimethylxaloylglycine) and intraperitoneal injection of the PHI in normal livers without portal vein rerouting, were compared. Liver volume was evaluated by CT scan. Proliferation of hepatocytes (HC) was evaluated by Ki-67 and DAPI staining. Liver sinusoidal endothelial cell (LSEC) density was evaluated by von Willebrand Factor (vWF) staining and hepatic stellate cell (HSC) activation by desmin staining. In vitro, HEP3B-cells (HC), LX2-cells (HSCs) and TRP3-cells (LSECs) were cultured under hypoxic conditions and under treatment with PHI. Proliferation was measured over 72h with the iCELLigence cell culture system via impedance. Conditioned media experiments were performed using media from HCs, HSCs and LSECs exposed to PHI for 24h and transferred to the other cell lines. Concentration of vascular endothelial growth factor (VEGF) was measured in hypoxic HSCs and blocked. Transcriptome analysis was performed using RNA extracts from hypoxia/PHI treated HSCs and media conditioned LSECs.

**Results:** PPVL induces slow liver regeneration, while ALPPS and PVL treated with PHI accelerates volume increase and Ki-67 proliferation by a factor of 1.8 and 3 respectively. While PHI without portal rerouting has no impact on volume, it leads to increased vascular density by vWF staining, also observed in ALPPS and PVL+DMOG. HSC activation is present in all rapid regeneration models and also the PHI treated normal livers without proliferation. In culture, PHI has an anti-proliferative effect on HCs, HSC and LSEC. However, transfer of media of PHI-treated HSC induces VEGF dependent proliferation of LSEC. Transcriptome analysis shows dominant expression of angiogenesis and matrix remodeling pathways.

**Conclusion:** In conclusion, hypoxia signaling by HSCs induces VEGF-dependent angiogenesis and leads to rapid liver regeneration in ALPPS.

#### Induction of anticancer immune responses: novel insights in mechanisms of hyperthermic intraperitoneal chemotherapy (HIPEC)

L. Roth, E. Breuer, R. Graf, P.-A. Clavien, A. Gupta, K. Lehmann

Department of Visceral and Transplant Surgery, University Hospital Zurich, Zurich, Switzerland

**Objective:** Cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) improved survival of selected patients with peritoneal metastasis from colorectal cancer. However, peritoneal recurrence is common and it is important to understand mechanisms operating behind HIPEC for further improvements. We hypothesized that the combination of chemotherapy and heat might not only be cytotoxic, but may also induce strong immunogenic changes within the tumor microenvironment. We therefore assessed effects of Mitomycin C/Doxorubicin (M/D) and Oxaliplatin (Oxa), widely used in the clinical setting, on the expression of immunogenic cancer-testis antigens (CTAs) on cancer cells after treatment with HIPEC-like conditions and subsequent monocyte-derived dendritic cell (Mo-DC) maturation and CD8+ T-cell activation.

**Methods:** Multiple colorectal cell-lines were treated with M/D or Oxa for 30 minutes +/- hyperthermia (43°C). 72 hours after treatment, CTA expression was analyzed using qPCR and western blot. To assess Mo-DC maturation and CD8+ T-cell activation, we set up co-cultures with colorectal cells, Mo-DC's and purified CD8+ T-cells. We analyzed surface markers such as HLA-DR and CD83 to assess Mo-DC maturation, and measured CD8+ T-cell activation via intracellular IFN- $\gamma$  staining using flow cytometry.

**Results:** HIPEC treatment induced de-novo expression of two CTAs, Cyclin A1 and SSX-4. Compared to controls (no drug, 37°C), M/D at hyperthermic condition increased Cyclin A1 by 53 folds and SSX-4 by 30 folds, similar to Oxa treated tumor cells. On protein level, Cyclin A1 was highly increased compared to control treatment ( $p = 0,004$ ). Mo-DC's, after co-culturing with HIPEC treated colorectal cancer cells, significantly expressed maturation markers CD83 and HLA-DR. Furthermore, Mo-DC's after activation by co-culture with HIPEC-treated cancer cells, were able to prime CD8+ T-cells, leading to enhanced IFN- $\gamma$  production by CD8+ T cells.

**Conclusion:** HIPEC treatment induces immunogenic changes in colorectal cancer cells and leads to Mo-DC maturation and subsequent CD8+ T-cell activation. These novel insights may explain observed long-term effect in selected patients, and represent a novel aspect of HIPEC, beyond cytotoxicity.

#### Interactions between platelets and liver sinusoidal endothelial cells promote hepatic stellate cells to drive liver regeneration

A. Balaphas<sup>1,2</sup>, J. Meyer<sup>1,2</sup>, R. Perozzo<sup>3</sup>, P. Fontana<sup>4,5</sup>, S. Berndt<sup>6</sup>, A. Turzi<sup>6</sup>, P. Morel<sup>1,2</sup>, L. Scapozza<sup>3</sup>, K. Sadoul<sup>7</sup>, C. Gonelle-Gispert<sup>2</sup>, L. Bühler<sup>1,2</sup>

<sup>1</sup>Division of Digestive Surgery, Geneva University Hospitals, Geneva, Switzerland, <sup>2</sup>Unit of Surgical Research, University of Geneva, Geneva, Switzerland, <sup>3</sup>Pharmaceutical Biochemistry group, School of Pharmaceutical Sciences University of Geneva, Geneva, Switzerland, <sup>4</sup>Division of Angiology and Haemostasis, Geneva University Hospitals, Geneva, Switzerland, <sup>5</sup>Geneva Platelet Group, University of Geneva, Geneva, Switzerland, <sup>6</sup>Regen Lab, Le Mont-sur-Lausanne, Switzerland, <sup>7</sup>Institute for Advanced Biosciences, University Grenoble Alpes, Grenoble, France

**Objective:** Platelets and liver sinusoidal endothelial cells (LSEC) are implicated in liver regeneration. Our aim was to investigate the interactions between platelets and LSEC in liver regeneration through the study of the release of growth factors by LSEC and hepatic stellate cells (HSC).

**Methods:** In vitro, freshly isolated pure mouse LSEC were co-incubated with resting platelets, activated platelets, or platelet releasates and secretion of various growth factors was measured with ELISA. To identify active components in platelet releasate, size exclusion chromatography was performed and resulting fractions were tested on LSEC for induction of growth factors secretion with ELISA. Conditioned culture medium of LSEC after exposure to platelets was added to primary HSC or hepatocytes and secretion of growth factors or cell proliferation was measured with ELISA and EdU assay. In vivo, platelets and LSEC interactions were analysed by confocal intravital microscopy after partial hepatectomy in mice.

**Results:** In vitro, co-incubation of resting platelets with LSEC resulted in a dose-dependent increase of interleukin-6 secretion (IL-6) by LSEC (IL-6:

75.4 ± 6.6 pg/ml after incubation with 16 million platelets versus 2 ± 1.1 pg/ml without platelets). The same effect was observed using activated platelets or release of activated platelets. Strikingly, IL-6 secretion was highest when high molecular weight fractions (> 80 kDa) of platelet release obtained by size exclusion chromatography were tested (IL-6 maximal: 1343 ± 245.8 pg/ml versus control 8 ± 0.2 pg/ml,  $p < 0.05$ ).

LSEC exposed to platelets did not increase proliferation of primary hepatocytes but stimulated HGF secretion by HSC (HGF: 574.1 ± 124.5 pg/ml after stimulation versus 397 ± 72.5 pg/ml without stimulation,  $p < 0.05$ ).

Following partial hepatectomy, adhesion of platelets to LSEC was significantly increased (55.2 ± 2.1% adherent platelets after partial hepatectomy versus 29.6 ± 1.6% after sham surgery,  $p < 0.05$ ).

**Conclusion:** Our in vitro observations indicate that activated platelets release a component(s) of proteic nature inducing IL-6 secretion by LSEC, which in turn enhances release by HSC of HGF, the strongest mitogen for hepatocytes. Our in vivo data confirm that platelets adhere to LSEC shortly after liver injury.

#### International multicentre cohort study for the external validation of CLASSIC – Classification of Intraoperative Complications

P. Kirchhoff<sup>1</sup>, N. V. Gomes<sup>2</sup>, L. Gawria<sup>3,4</sup>, L. Villarino<sup>5</sup>, M. I. Rochera<sup>5</sup>, A. Solis<sup>6</sup>, R. Martin<sup>6</sup>, C. Blanc<sup>7</sup>, O. Gié<sup>8</sup>, D. Hahnloser<sup>8</sup>, H. Van Goor<sup>4</sup>, R. ten Broek<sup>4</sup>, C. Rosman<sup>4</sup>, P. Schuhmacher<sup>9</sup>, C. Brandt<sup>9</sup>, R. Schmid<sup>10</sup>, S. Joller<sup>11</sup>, B. Goebel<sup>12</sup>, J. Mayr<sup>12</sup>, S. Meier<sup>13</sup>, S. J. Kang<sup>13</sup>, M. Aduse-Poku<sup>13</sup>, P. Delrio<sup>14</sup>, D. Rega<sup>14</sup>, U. Pace<sup>14</sup>, B. Loveday<sup>15</sup>, I. Bissett<sup>15</sup>, G. O'Grady<sup>15</sup>, F. Herbst<sup>16</sup>, S. Ghaffari<sup>16</sup>, A. Engel<sup>17</sup>, J. Murugesan<sup>18</sup>, M. Ozcelik<sup>19</sup>, I. E. Gecim<sup>20</sup>, O. Ioannidis<sup>21</sup>, K. Galanos<sup>21</sup>, D. Vrochides<sup>22</sup>, M. Passeri<sup>22</sup>, P. F. Ridgway<sup>23</sup>, C. Clancy<sup>23</sup>, D. M. Nally<sup>23</sup>, H. R. Bruppacher<sup>24</sup>, B. Ranter<sup>25</sup>, S. Rabanser<sup>26</sup>, L. A. Steiner<sup>2,27</sup>, P. A. Clavien<sup>28</sup>, R. Rosenthal<sup>29</sup>, S. Dell-Kuster<sup>2,27,30</sup>

<sup>1</sup>Department of Surgery, University Hospital Basel, Basel, Switzerland, <sup>2</sup>Department of Anaesthesiology, University Hospital Basel, Basel, Switzerland, <sup>3</sup>Institute for Clinical Epidemiology and Biostatistics, University of Basel, Basel, Switzerland, <sup>4</sup>Department of Surgery, Radboud University Medical Centre, Nijmegen, Netherlands, <sup>5</sup>Department of Anaesthesiology and Reanimation, Hospital Valle de Hebron, Barcelona, Spain, <sup>6</sup>Colorectal Surgery Unit, Hospital Valle de Hebron, Barcelona, Spain, <sup>7</sup>Department of Anaesthesiology, Lausanne University Hospital, Lausanne, Switzerland, <sup>8</sup>Department of Visceral Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>9</sup>Department of Anaesthesiology, Bürgerspital Solothurn, Solothurn, Switzerland, <sup>10</sup>Department of Surgery, Bürgerspital Solothurn, Solothurn, Switzerland, <sup>11</sup>Department of Anaesthesiology, University Children's Hospital Basel, Basel, Switzerland, <sup>12</sup>Department of Surgery, University Children's Hospital Basel, Basel, Switzerland, <sup>13</sup>Department of Anaesthesiology, Guy's and St. Thomas' Hospital, London, United Kingdom, <sup>14</sup>Department of Colorectal Surgical Oncology, National Cancer Institute (IRCCS) G. Pascale Foundation, Naples, Italy, <sup>15</sup>Department of Surgery, University of Auckland, Auckland, New Zealand, <sup>16</sup>Department of Surgery, Hospital of St. John of God Vienna, Sigmund Freud University Vienna - Medical School, Vienna, Austria, <sup>17</sup>Department of Anaesthesiology and Reanimation, University of Sydney, Sydney, Australia, <sup>18</sup>Royal North Shore Hospital, University of Sydney, Sydney, Australia, <sup>19</sup>Department of Anaesthesiology, Ankara University Medical School, Ankara, Turkey, <sup>20</sup>Department of Surgery, Ankara University Medical School, Ankara, Turkey, <sup>21</sup>Fourth Surgical Department, Medical School, Aristotle University of Thessaloniki, Thessaloniki, Greece, <sup>22</sup>Department of Surgery, Carolinas Medical Center, Charlotte, USA, <sup>23</sup>Department of Surgery, Tallaght University Hospital, Dublin, Ireland, <sup>24</sup>Department of Anaesthesiology, Schulthess Clinic Zurich, Zurich, Switzerland, <sup>25</sup>Department of Vascular Surgery, Medical University of Innsbruck, Innsbruck, Austria, <sup>26</sup>Department of Anaesthesiology, Cantonal Hospital Graubünden, Chur, Switzerland, <sup>27</sup>Department of Clinical Research, University of Basel, Basel, Switzerland, <sup>28</sup>Department of Surgery and Transplantation, University Hospital Zurich, Zurich, Switzerland, <sup>29</sup>Medical Faculty, University of Basel, Basel, Switzerland, <sup>30</sup>Institute for Clinical Epidemiology and Biostatistics University of Basel, University Hospital Basel, Basel, Switzerland

**Objective:** This international prospective cohort study aimed to assess the external validity and practicability of CLASSIC, a newly developed Classification of Intraoperative Complications (CLASSIC). The updated CLASSIC defines 5 severity grades depending on the need for treatment and severity of symptoms.

**Methods:** In 18 centres from 12 countries, patients undergoing any type of surgery were consecutively enrolled, excluding one-day surgeries (NCT03009929). The attending surgical and anaesthesia team graded all intraoperative complications according to CLASSIC. All postoperative complications were assessed daily until hospital discharge and graded using the Clavien-Dindo classification. The association between the most severe intra- and postoperative complication (primary endpoint) was investigated using Spearman's rho. The association between the most severe intraoperative complication and the postoperative length of stay (pLOS; secondary endpoint) was investigated in a multivariable median regression model with robust standard errors considering study centre clustering. This analysis was adjusted for age, ASA-class, wound classification, complexity and urgency of the procedure. In a survey including 10 fictitious case scenarios describing intraoperative complications, reliability of CLASSIC was assessed using the intra-class correlation coefficient (ICC).

**Results:** Out of 2640 patients screened, 2520 patients were enrolled, of which 610 (24%) experienced any intraoperative complication. 2508 postoperative complications were observed in 838 patients (33%). In-hospital mortality was 1% (n = 25). The Spearman correlation between the most severe intra- and postoperative complication was 0.22 ( $p < 0.001$ ). In multivariable analysis, median pLOS increased with each CLASSIC grade (from 0.5 days (95% CI -0.03, 1.03) for Grade I vs 0, up to 4.5 days (95% CI 0.50, 8.50) for Grade IV vs 0). The survey (response rate 80%) showed an ICC of 0.75 (95% CI 0.59, 0.91). Practicability of CLASSIC was rated as 6 (IQR 5-7) out of 9.

**Conclusion:** CLASSIC provides a validated and standardised tool to quantify and qualify intraoperative complications in clinical practice and research with a high reliability and practicability. Intraoperative complications show an association with important postoperative outcomes, rendering CLASSIC a useful tool to enhance perioperative patient safety.

#### LIM protein ajuba promotes cancer cell proliferation and survival in hepatocellular carcinoma

N. Dommann<sup>1</sup>, J. Gavini<sup>1</sup>, D. Sánchez-Taltavull<sup>1</sup>, T. Brodie<sup>2</sup>, M. Medova<sup>3</sup>, M. Humbert<sup>4</sup>, M. Tschan<sup>4</sup>, D. Candinas<sup>1</sup>, D. Stroka<sup>1</sup>

<sup>1</sup>Department of BioMedical Research Bern, Visceral Surgery and Medicine, Inselspital, University Hospital of Bern, University of Bern, Bern, Switzerland, <sup>2</sup>Mass Cytometry Facility, University of Zurich, Zurich, Switzerland, <sup>3</sup>Department of BioMedical Research Bern, Radiation Oncology, Inselspital, University Hospital of Bern, University of Bern, Bern, Switzerland, <sup>4</sup>Department of Tumor Pathology, Institute of Pathology, Inselspital, University Hospital of Bern, University of Bern, Bern, Switzerland

**Objective:** The LIM-domain protein Ajuba is a structural protein involved in the Hippo pathway and has a role in the maintenance of cell junctions, migration, differentiation, and proliferation. There are discrepancies in the literature as to whether it is a driver or suppressor of proliferation and little is known about it in the context of hepatocellular carcinoma (HCC). The aim of this study was to characterize Ajuba expression and function in HCC.

**Methods:** We screened 10 human liver cancer cell lines and primary tumors comparing them to control liver tissue or cultured primary human hepatocytes for protein and mRNA expression of Ajuba. The function of Ajuba was investigated by modulating its protein level with lentiviruses expressing shRNA targeted sequences (KD) or an overexpressing (OE) construct. The biological impact of Ajuba KD and OE transduced cells was tested in-vitro with various biological assays including RT2 Profiler PCR Arrays looking at Hippo pathway and cell cycle, Mass spectrometry of exogenous Ajuba and a 42-parameter panel for mass cytometry, and in an in-vivo syngeneic mouse tumor model.

**Results:** Steady state levels of Ajuba mRNA in human liver cancer cell lines and primary tumors were significantly higher than in primary human hepatocytes or control liver tissue. Lentiviral transduction of HCC cell lines effectively knocked-down Ajuba protein resulting in a decrease of proliferation, migration, and colony formation, which coincided with a G2-phase cell cycle arrest and enhanced radiosensitivity. Previously published binding partners of Ajuba could be confirmed and new proteins were identified as Ajuba-binding using Mass spectrometry. Mass cytometry allowed the identification of new pathways in which Ajuba might be involved. Using a syngeneic tumor model in C57BL/6 mice, RIL-175 (mouse HCC cell line) transduced cells with knocked down Ajuba showed a significantly reduced tumor volume compared to controls.

**Conclusion:** Ajuba overexpression appears to be central to HCC cell proliferation and knock down reduces tumor growth.

#### Load-induced changes in articular cartilage biomarkers before and after a high tibial osteotomy in patients with medial compartment knee osteoarthritis

A. Mündermann<sup>1,2,3</sup>, A.-M. Liphardt<sup>4,5</sup>, G. Pagenstert<sup>6</sup>, C. Egloff<sup>1</sup>, C. Nueesch<sup>1,2,3</sup>

<sup>1</sup>Department of Orthopaedics and Traumatology, University Hospital Basel, Basel, Switzerland, <sup>2</sup>Department of Biomedical Engineering, University of Basel, Basel, Switzerland, <sup>3</sup>Department Clinical Research, University of Basel, Basel, Switzerland, <sup>4</sup>Department of Rheumatology and Immunology, University Hospital Erlangen, Erlangen, Germany, <sup>5</sup>Institute of Biomechanics and Orthopaedics, German Sport University Cologne, Cologne, Germany, <sup>6</sup>Orthopaedics, Praxis Clarabof, Basel, Switzerland

**Objective:** High tibial osteotomy (HTO) is a joint preserving surgery in patients with varus knee alignment and knee osteoarthritis. The goal of HTO is achieving a balanced transfer of ambulatory load between the medial and lateral compartments of the knee. We investigated load-induced changes in biomarkers of articular cartilage metabolism before and after opening wedge HTO in patients with medial compartment knee osteoarthritis.

**Methods:** Blood samples of ten patients (6 male; 44.3 ± 8.6 years, 25.8 ± 3.9 kg/m<sup>2</sup>) were collected 4 weeks before and 6 months after HTO, each time immediately before (t0) and 0, 0.5, 1.5, 3.5, and 5.5 hours (t1-t5) after a 30-minute walking exercise on an instrumented treadmill. Serum levels of cartilage oligomeric matrix protein (COMP), matrix metalloproteinase (MMP)-3, -1, 9, interleukin- (IL)-6, C-propeptide II (CPII), cleavage of type II collagenases (C2C), Proteoglycan 4 (PRG-4) und A disintegrin and metalloproteinase with thrombospondin motifs 4 (ADAMTS-4) were analyzed using commercial ELISA kits. Differences in serum levels were detected using ANOVA for repeated measures with surgery (pre/post) and time after 30-minute walking as within subject factors (P < 0.05).

**Results:** Baseline COMP values were higher and C2C and CPII values were lower after the HTO (P < 0.05). Both pre- and postoperatively, COMP, MMP-3, C2C, and CPII increased by 10 to 70% immediately after the walking exercise, and PRG-4 decreased by 43% (P < 0.05). Up to 5.5 hours after the walking exercise, COMP and MMP-3 decreased to up to 25% below the baseline levels. IL-6 decreased 3.5 and 5.5 hours after the walking stress test by more than 400 and 500%, respectively. Both pre- and postoperatively, PRG-4 and MMP-9 showed clear maxima 3.5 hours after the walking exercise.

**Conclusion:** The immediate and delayed load-induced changes in biomarkers of articular cartilage not only suggest diffusion of biomarkers but also (possibly delayed) metabolic processes, respectively. The decrease in PRG-4 – or lubricin – immediately after the walking exercise may indicate increased friction of the arthritic joint. The lacking pre- to postoperative differences in load-induced changes in cartilage biomarkers may be caused by individually different load corrections of the HTO, which may result in individually different magnitude of load-induced changes. We will evaluate these possibilities in subsequent analyses.

## Hand

#### Shorter rehabilitation after extensor pollicis longus reconstruction combining side-to-side tendon attachment and new active rehabilitation protocol

T. Cordier, S. Schibli

Department of Hand Surgery, Cantonal Hospital Graubünden, Chur, Switzerland

**Objective:** Rupture of the Extensor pollicis longus tendon (EPL) is frequently associated with distal radius fractures. For EPL reconstruction the Extensor indicis tendon (EI) is transferred to the distal end of the EPL. Common suture techniques combined with established rehabilitation protocols have proven to achieve good results. However, patients regularly experience restrictions of hand function for three months. In addition, current rehabilitation protocols tend to be complex and depend on substantial support from hand therapists.

Compared to the Pulvertaft technique, the Side-to-Side (STS) suture technique provides improved strength and has been successfully implemented for tendon transfers.

In this prospective study we analysed, whether combining a Side-to-Side suture technique with a straightforward active rehabilitation protocol based on the increased suture stability simplifies and shortens time of rehabilitation after EPL reconstruction.

**Methods:** Between 11/2015 and 04/2017 we treated a series of 10 patients, median age 56 (range 18-70) after closed EPL-rupture using STS suture technique for EI to EPL transfer. For postoperative rehabilitation we implemented a simplified Controlled-Active-Motion protocol. Clinical follow up was at 2, 4 and 8 weeks postoperatively and additionally one year later by phone. Primary endpoints were the unrestricted use of the operated hand or major complications, defined as tendon rupture or relevant tendon elongation. We reported on patient satisfaction and pain. As objective parameter active range of motion of the thumb and index finger as well as pinch and grip strength were measured.

**Results:** All 10 patients underwent surgery and postoperative rehabilitation without complication. All 10 were satisfied with the treatment 8 weeks and one year postoperatively. All were back to work after 8 weeks or could use the operated hand without any restriction. At 8 weeks all patients achieved a powerful active extension of the IP-joint of the thumb. Pinch- and grip- strength reached on average 83% and 81% of the contralateral side.

**Conclusion:** Despite the small group and the relative short follow up the results suggest that the Side-to-side suture technique in combination with an adapted active rehabilitation protocol provides a safe and successful method for EPL reconstruction. Compared with the current literature this concept shortens time of rehabilitation by a third.

## Hepato-pancreatobiliary

#### Impact on survival and recurrence of positive histological resection after pancreatoduodenectomy in patients with lymph node invasion: an international multicentric study

G.-R. Joliat<sup>1</sup>, P. Allemann<sup>1</sup>, I. Labgaa<sup>1</sup>, J. Sulzer<sup>2</sup>, D. Vrochides<sup>2</sup>, A. Zerbi<sup>3</sup>, G. Nappo<sup>3</sup>, J. Perinel<sup>4</sup>, M. Adham<sup>4</sup>, M. Nentwich<sup>5</sup>, J. Izbicki<sup>5</sup>, N. Demartines<sup>1</sup>, M. Schäfer<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>2</sup>Division of Hepatobiliary and Pancreatic Surgery, Carolinas Medical Center, Charlotte, USA, <sup>3</sup>Pancreatic Surgery Section, Humanitas Cancer Center, Milan, Italy, <sup>4</sup>Department of Digestive Surgery, Edouard Herriot Hospital, Lyon, France, <sup>5</sup>Department of Visceral Surgery, University Medical Center Hamburg-Eppendorf, Hamburg, Germany

**Objective:** Incomplete resection (R1) after pancreatoduodenectomy and lymph node (LN) invasion have been described as factors of poor prognosis in patients with pancreatic ductal adenocarcinoma (PDAC). It is nevertheless unclear if R0 resection after pancreatoduodenectomy compared to R1 resection has a real positive impact on survival and recurrence in patients with LN invasion. This study aimed to compare overall survival (OS) and recurrence rate between R0 and R1 resections among PDAC patients with LN invasion.

**Methods:** A retrospective international multicentric study was performed including 5 tertiary centers (1 in the USA and 4 in Europe). Patients with PDAC without neoadjuvant treatment were included. R1 resection was defined as positive histological margins. Survival was measured from operation date to last follow-up date or death. Median OS was calculated using Kaplan-Meier curves and compared using log-rank tests. Multivariable Cox regression analysis was performed to find negative predictive factors for OS.

**Results:** From the 5 participating centers, 990 patients with pancreatoduodenectomy for PDAC were included. A total of 789 patients had LN invasion (80%) and 201 had no LN invasion (20%). Perioperative mortality was 3% (30/990) and overall morbidity 60% (593/990). For the entire cohort, median OS was 24 months (95% CI: 22-26). Median OS was longer for patients without LN invasion compared to patients with LN invasion (45 vs. 21 months, p < 0.001). Recurrence after R0 resection was also lower in patients without LN invasion (26%) compared to patients with LN invasion (52%, p < 0.001).

Among patients with LN invasion, median OS was similar between patients with R0 and R1 resection (25 vs. 22 months,  $p=0.646$ ). Recurrence rates were also similar between R0 and R1 resections (209/391 = 53% vs. 195/355 = 55%,  $p=0.686$ ). On multivariable analysis R1 resection was not an independent factor of worse OS (HR: 0.9, 95% CI: 0.8-1.2,  $p=0.958$ ). Only tumor size was associated with poor OS (HR: 1.1, 95% CI: 1-1.1,  $p=0.045$ ).

**Conclusion:** In PDAC patients with pathological positive LN invasion, resection status had no influence on OS and recurrence rates. Extensive surgery to achieve R0 resection in such patients might not influence the course of the disease.

#### Initial experience of "Double" portal and hepatic vein occlusion to induce rapid liver hypertrophy – comparison of two different techniques

F. Heid<sup>1</sup>, T. Gimenez Maurel<sup>2</sup>, L. F. Grochola<sup>1</sup>, S. Breitenstein<sup>1</sup>, C. A. Binkert<sup>3</sup>, A. Serrablo<sup>2</sup>, E. Schadde<sup>1,4</sup>

<sup>1</sup>Department of Visceral and Thoracic Surgery, Cantonal Hospital Winterthur, Winterthur, Switzerland, <sup>2</sup>Department of Surgery, Miguel Servet University Hospital Zaragoza, Zaragoza, Spain, <sup>3</sup>Institute of Radiology and Nuclear Medicine, Cantonal Hospital Winterthur, Winterthur, Switzerland, <sup>4</sup>Department of Surgery, Rush University Medical Center, Chicago, USA

**Objective:** The combination of the simultaneous occlusion of the portal veins supplying and the hepatic veins draining the liver (DVO) has been shown to induce rapid hypertrophy of the future liver remnant (FLR) in animal studies and pilot human studies. This study compares two different methods of DVO in two different centers.

**Methods:** The records of patients undergoing embolization of both portal and hepatic veins in a Swiss and Spanish center were reviewed. Demographics, indications and liver volume were analyzed by standardized liver remnant volume (sFLR), liver to body mass ratio (LBWR) and clinical outcomes were assessed. Technical difference between the two centers were compared. The primary interest was feasibility of resection.

**Results:** Between 09/2017–11/2018, the Swiss and the Spanish center performed DVO in 5 and 8 patients, respectively. The Spanish center performed portal vein ligation in a first stage and then hepatic vein embolization by interventional radiology (IR) after an average of 8.9 days, the Swiss center performed simultaneous portal and hepatic vein embolization by IR. Diagnosis was bi-lobar colorectal liver metastasis (CRLM) in 12 patients, and intrahepatic cholangiocarcinoma (IHCC) in one patient. 12/13 patients underwent resection (feasibility 92%). Median age was 54 (IQR 50 - 66) years. sFLR and LBWR were 0.26% and 0.58, respectively, prior to DVO, 0.40% and 0.88 at a median of 20 days afterwards. The kinetic growth rates between the Swiss and the Spanish cohort were comparable (0.13% sFLR/week vs. 0.05% sFLR/week,  $p=0.14$ ).

**Conclusion:** Occlusion of portal and hepatic veins can be achieved using different methods to gain comparable volume growth in this small series. This novel technique has to be studied further prospectively and compared to the gold standard of portal vein embolization.

#### ITPP - a novel hypoxia-modifier as a potential antitumor agent in patients with hepato-pancreato - biliary neoplasms – results of a phase IB clinical trial

P. Limani<sup>1</sup>, M. A. Schneider<sup>1</sup>, M. Linecker<sup>1</sup>, B. Pestalozzi<sup>2</sup>, P. Kron<sup>1</sup>, A. Jetter<sup>3</sup>, C. Nicolau<sup>4</sup>, J.-M. Lehn<sup>5</sup>, H. Petrowsky<sup>1</sup>, B. Humar<sup>1</sup>, R. Graf<sup>1</sup>, P.-A. Clavien<sup>1</sup>

<sup>1</sup>Department of Surgery and Transplantation, University Hospital Zurich, Zurich, Switzerland, <sup>2</sup>Department of Medical Oncology, University Hospital Zurich, Zurich, Switzerland, <sup>3</sup>Department of Pharmacology and Toxicology, University Hospital Zurich, Zurich, Switzerland, <sup>4</sup>Friedman School of Nutrition and Science, Tufts University, Boston, USA, <sup>5</sup>Institute of Supramolecular Science and Engineering, University of Strasbourg, Strasbourg, France

**Objective:** Hypoxia occurs in solid tumors and leads to increased invasiveness due to epithelial-mesenchymal transformation, activation of the Warburg effect and decreased anti-tumor immunological responses. The novel anti-hypoxic molecule myo-inositoltrisphosphosphate (ITPP, OXY111A) acts as an allosteric

effector of hemoglobin and counteracts counteracts hypoxia-induced tumor aggressiveness showing decreased tumor burden and increased survival in five different animal solid tumor models both applied as monotherapy and increased beneficial effects when followed by standard chemotherapy.

**Methods:** The present study is a first in-human exploratory, prospective, open-labelled, mono-centric Phase IB study according to a classical 3+3 dose escalation design (ClinicalTrials.gov Identifier: NCT02528526) in patients with non-resectable primary and secondary tumors of the liver, pancreas, and biliary tract. The study intervention consists of 9 infusions of ITPP over 3 weeks, followed by administration of conventional cytotoxic chemotherapy. Primary endpoint is the determination of safety and tolerability of ITPP, secondary endpoint is assessment of efficacy/tumor response with FDG-PET/CT and MRI.

**Results:** 30 patients were included between 04/2015 and 12/2017, with 1 patient withdrawn from the study and 22 assessed for the primary endpoint. ITPP administration was safe, well tolerated and no dose-limiting toxicity was encountered up to the maximal dose currently tested (Cohort 7: 12\*390mg/m<sup>2</sup>). 6 serious adverse events were recorded, none of it related to ITPP. 30 adverse events occurred, with 15 of those judged to be possibly or definitively related to ITPP, with 11 patients experiencing hypercalcemia, 2 hyponatremia, 1 hypomagnesemia and 1 hypokalemia (all CTCAE Grade 1). 8 patients had radiological disease stabilization under ITPP treatment with 3 patients experiencing a decrease in tumor markers. 4 patients had stable disease under consequent chemotherapy, while 5 benefited of a strong partial response.

**Conclusion:** Administration of ITPP before chemotherapy is safe and well tolerated with negligible side-effects. Further exploration of its anti-tumor efficacy in Phase II/III trials is highly warranted.

#### Natural Orifice Transluminal Endoscopic Surgery (NOTES): nine years' experience with 571 hybrid transvaginal cholecystectomies

F. Rössler, U. Bieri, A. Keerl, A. Nocito

Department of Surgery, Cantonal Hospital Baden, Baden, Switzerland

**Objective:** To assess outcome and safety of 571 hybrid NOTES cholecystectomies, representing the largest single-center cohort.

**Methods:** We retrospectively analyzed all consecutive NOTES cholecystectomies performed in our center between June 2009 and January 2018. All procedures were performed using a hybrid transvaginal technique, including an additional umbilical small-size trocar. Endpoints, calculated at discharge, 30 and up to 90 days postoperatively, included intra- and postoperative morbidity assessed by the validated Clavien-Dindo Classification and the Comprehensive Complication Index (CCI). Special focus was held on pre- and postoperative gynecological conditions and whether or not preoperative gynecological examination is necessary in all patients.

**Results:** We performed 571 hybrid NOTES cholecystectomies within nine years. The vast majority were elective, 9.6% emergency cholecystectomies. Mean operation time was 64 ( $\pm 25$ ) minutes and mean hospital stay 2.56 ( $\pm 3.3$ ) days, (range 1 to 54 days). 6.7% of patients developed at least one complication until discharge, most of them minor ( $\leq$ Grade II), mainly due to urinary infections or retention. 30- and 90-day complication rates were 10.7% and 11%, respectively. Mean CCI at discharge, postoperative day 30 and 90 was 1.45 ( $\pm 6.4$ ), 2.3 ( $\pm 7.7$ ) and 2.4 ( $\pm 7.8$ ) respectively, ranging from 0 to 60.1. 1.6% of patients developed major complications ( $\geq$  Grade IIIa) and four patients required emergency reoperation. No mortality was observed. In 9.8% an additional abdominal trocar was placed, but only one patient needed conversion to laparotomy. All patients underwent routine gynecological examination, whereof only five were rejected for transvaginal access preoperatively. In no case transvaginal access was discontinued intraoperatively due to gynecological disease.

**Conclusion:** Hybrid NOTES transvaginal cholecystectomy represents a safe and feasible alternative to standard laparoscopic cholecystectomy. Preoperative gynecological examination is no longer routinely necessary, as intraoperative assessment is adequate.

### Prospective trial to evaluate the prognostic value of different nutritional assessment scores in liver surgery

P. Probst<sup>1</sup>, J. Fuchs<sup>1</sup>, M. R. Schoen<sup>2</sup>, G. Polychronidis<sup>1</sup>, C. Stravodimos<sup>2</sup>, A. Mehrabi<sup>1</sup>, M. K. Diener<sup>1</sup>, P. Knebel<sup>1</sup>, K. Hoffmann<sup>1</sup>

<sup>1</sup>Department of General, Visceral and Transplantation Surgery, University of Heidelberg, Heidelberg, Germany, <sup>2</sup>Department of General and Visceral Surgery, Municipal Hospital of Karlsruhe, Karlsruhe, Germany

**Objective:** Malnutrition is recognized as a preoperative risk factor for patients undergoing hepatic resection. To take preventive therapeutic actions before surgery, it is important to identify malnourished patients. However, there is no evidence, which existing nutritional assessment score (NAS) is suited best to predict the postoperative outcome in liver surgery.

**Methods:** All patients scheduled for elective liver resection were screened for eligibility. Before surgery, every patient was assessed to be at risk for malnutrition or not according to Nutritional Risk Index, Nutritional Risk Screening original and 2002, Subjective Global Assessment, Malnutrition Universal Screening Tool, Mini Nutritional Assessment original and SF, Short Nutritional Assessment Questionnaire, Imperial Nutritional Screening System I+II, Nutritional Risk Classification and the ESPEN malnutrition criteria. Throughout the patient's hospital stay, postoperative morbidity and mortality was tracked prospectively. The association of malnutrition according to each score and occurrence of at least one major complication was the primary endpoint, using a multivariable logistic regression analysis including established risk factors in liver surgery as covariates.

**Results:** The population consisted of 182 patients. The percentage of patients labelled as malnourished by the NAS varied among the different scores, with the lowest being at 2.2% (Mini Nutritional Assessment) and the highest at 52.2% (Nutritional Risk Classification). In 40 patients (22.0%) a major complication was observed. None of the scores showed a significant association with the occurrence of major complications in the multivariable analysis.

**Conclusion:** None of the twelve NAS investigated defined a state of malnutrition which was independently associated with postoperative complications. A delay of surgery by a diagnosed malnutrition based on these NAS are not justified. Other measures to determine malnutrition in liver surgery should be investigated prospectively.

### Survival after hepatectomy for colorectal liver metastases is a function of intrahepatic recurrence but is not dependent of recurrence at the liver resection margin

A. Andreou<sup>1</sup>, D. Kradolfer<sup>1</sup>, M. Maurer<sup>2</sup>, S. Knitter<sup>1</sup>, A. Lachenmayer<sup>1</sup>, V. Banz<sup>1</sup>, D. Candinas<sup>1</sup>, G. Beldi<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery and Medicine, Inselspital, University Hospital of Bern, University of Bern, Bern, Switzerland, <sup>2</sup>Department of Radiology, Inselspital, University Hospital of Bern, University of Bern, Bern, Switzerland

**Objective:** Resection margin status is associated with oncologic outcomes following liver resection for colorectal liver metastases (CLM). Previous studies however, did not differentiate between true local recurrence at the resection margin versus recurrence elsewhere in the liver. This study aims to determine if resection margin represents only a surrogate of advanced disease while not causally determining overall survival (OS).

**Methods:** Clinicopathological data of patients who underwent curative hepatic resection for CLM between 2012 and 2017 at a major hepatobiliary center in Switzerland were assessed. Follow-up cross-sectional imaging following hepatectomy was reviewed by an independent radiologist to identify the presence and location of recurrent disease. Location of intrahepatic recurrence was distinguished in true local recurrence (only at the resection margin) versus intrahepatic recurrence elsewhere. The association between surgical margin status and location and frequency of tumor recurrence was evaluated and the impact of true local recurrence on OS was analyzed.

**Results:** During the study period, 91 patients underwent liver resection for CLM with curative intent. Surgical margins were positive for tumor cells (R1) in 10 patients (11%). After a median follow-up time of 47 months, tumor recurrence was identified in 54 patients (59%). Location of recurrence disease was independent from the R1 status ( $p=0.063$ ). True local recurrence was not associated with worse OS among patients with recurrent disease (true local recurrence vs. elsewhere: 3-year OS: 73% vs. 65%,  $p=0.729$ ).

Main determinants of survival were no recurrence, any intrahepatic recurrence, and extrahepatic recurrence ( $p=0.012$ ).

**Conclusion:** R1 margin status was not associated with more frequent true local recurrence compared to other locations of recurrent disease. Additionally, the impact of true local recurrence on OS was not significantly different from that of any intrahepatic recurrent disease. Thus, based on our findings, R1 status should be considered as a surrogate parameter of extensive disease and potentially aggressive tumor biology. It should be used as an indicator for the need of intensive systemic treatment and close postoperative surveillance.

### Systematic review and meta-analysis of thrombocytopenia as a predictor of post-hepatectomy liver failure

J. Meyer<sup>1</sup>, A. Balaphas<sup>1</sup>, C. Combescure<sup>2</sup>, P. Morel<sup>1</sup>, C. Gonelle-Gispert<sup>3</sup>, L. Bühler<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Geneva University Hospitals, Geneva, Switzerland,

<sup>2</sup>Department of Epidemiology, Geneva University Hospitals, Geneva, Switzerland,

<sup>3</sup>Unit of Surgical Investigations, University of Geneva, Geneva, Switzerland

**Objective:** Platelet counts correlate with liver regeneration and post-hepatectomy liver failure in animal models. To determine if a similar effect of platelet count exists in humans, we performed a systematic review and meta-analysis to assess whether thrombocytopenia constituted a risk factor for post-hepatectomy liver failure (PHLF).

**Methods:** We searched MEDLINE and EMBASE from inception until February the 17th, 2018 for studies reporting cases of PHLF in patients with and without thrombocytopenia (defined as a platelet count below 100 or 150 (G/l)) and/or platelet counts in patients with and without PHLF. Pooled odd ratios for PHLF, as well as mean difference in platelet counts between patients with and without PHLF, were obtained by random effects models. Robustness was tested by subgroups and leave-one out sensitivity analyses. Heterogeneity was assessed using the Q-test and quantified based on I2 value.

**Results:** We included 15 studies representing 3966 patients. Pooled odds ratio for PHLF in thrombocytopenic patients was 3.71 (95% CI : 2.51 to 5.48 ; I2 = 0%). Pooled odds ratio was 5.53 (95% CI: 2.85 to 10.48) when pooling only studies based on preoperative platelet count, and 3.13 (95% CI: 1.75 to 5.58) when pooling studies including only patients without liver cirrhosis. The pooled mean difference in platelet counts between patients with and without PHLF was -21.2 (G/l) (95% CI: -36.1 to 6.4) in disfavor of patients with PHLF. When pooling only patients with various qualities of liver tissue, the pooled mean difference was 0.6 (G/l) (95% CI: -21.1 to 22.2).

**Conclusion:** Preoperative and/or postoperative thrombocytopenia constitute significant risk factors for PHLF in cirrhotic and non-cirrhotic patients.

### Treatment of alveolar echinococcosis in immunocompromised and immunocompetent patients

A. Lachenmayer, D. Gebbers, D. Candinas, G. Beldi

Department of Visceral Surgery and Medicine, Inselspital, University Hospital of Bern, Bern, Switzerland

**Objective:** Human alveolar echinococcosis (AE) is a zoonosis caused by metacystodes shed by feces of wild foxes. For this study we aimed to address the hypothesis that AE is an opportunistic disease by using epidemiological data.

**Methods:** Retrospective analysis of 131 patients with a median age of 54 years treated for AE between 1971 and 2017 at a swiss high-volume university center. Fifty-two % were females and 65 (49.6%) patients were diagnosed incidentally. Fourteen patients (15.9%) were operated laparoscopically. Overall median follow-up was 48 months.

**Results:** A significant increase of new diagnoses in general and of co-existing immunosuppressive conditions in the past decade were observed ( $p \leq 0.005$ ). Forty-one (31.3%) patients had co-existing or previous immunosuppressive conditions including 16 (36%) malignancies, 11 (31%) auto-immune diseases or immunosuppressive therapies, 5 (11%) infectious diseases, 4 (9%) chronic asthma conditions, 2 (4%) previous transplantations and 4 (9%) other immune compromising conditions. Serologies of EM18, EM<sup>2</sup> and EgHF were not associated with immunocompetence at diagnosis, but significantly decreased after treatment with Benzimidazole ( $n=43$ ) or surgery ( $n=88$ ).

Neoadjuvant ( $p=0.042$ ), adjuvant therapy for  $\geq 1$  year ( $p=0.007$ ) with benzimidazole and resection status (R0) ( $p=0.002$ ) were significantly correlated with recurrence-free survival. Survival at 5 and 10 years after surgery was 97.3% and 94.2%, respectively, and after conservative treatment 91.2% and 73%, respectively. Surgical approach ( $p=0.014$ ) and immunocompetence ( $p=0.048$ ) were significantly correlated with overall survival.

**Conclusion:** The incidence of human AE is increasing over the last decades that may not only be explained by the urban and rural increase of fox populations. We have observed an association of immunosuppressive conditions with both incidence and survival of AE. Therefore human AE may be considered at least in part as an opportunistic disease.

#### Tumor biology determines recurrence patterns after radical surgery for peritoneal metastasis: same but different

E. Breuer<sup>1</sup>, M. A. Schneider<sup>1</sup>, L. Roth<sup>1</sup>, J. Eden<sup>2</sup>, B. Pache<sup>3</sup>, T. Steffen<sup>2</sup>, M. Hübner<sup>3</sup>, A. Gupta<sup>1</sup>, V. Kepenekian<sup>4</sup>, G. Passot<sup>4</sup>, P. Gertsch<sup>1</sup>, O. Glehen<sup>4</sup>, K. Lehmann<sup>1</sup>

<sup>1</sup>Department of Surgery and Transplantation, University Hospital Zurich, Zurich, Switzerland, <sup>2</sup>Department of Surgery, Cantonal Hospital St. Gallen, St. Gallen, Switzerland, <sup>3</sup>Department of Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>4</sup>Department of Surgical Oncology, University Hospital of Lyon, Lyon, France

**Objective:** Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy (CRS/HIPEC) improve survival in selected patients with peritoneal metastasis (PM) from colorectal cancer. Disease recurrence is, however, frequent and can occur in the peritoneum or hematogenous (lung, liver). Currently, no data is available about factors predicting the localization of recurrent disease and its impact on survival.

**Methods:** The present study is a multicentric retrospective cohort analysis from four European tertiary centers and includes patients with colorectal PM between 2005 – 2017. Patients received standard perioperative chemotherapy. HIPEC was indicated after radical cytoreduction (CC-score 0) and performed at 42°C for 90 minutes with mitomycin C/doxorubicin ( $\geq 15$  mg/m<sup>2</sup>) or 43°C for 30 minutes with oxaliplatin (300-400 mg/m<sup>2</sup>). Statistical analyses were performed with IBM SPSS (version 25, Chicago, IL). The study was approved by the responsible ethics committee.

**Results:** A cohort of  $n=433$  patients with colorectal PM was analyzed after CRS/HIPEC with curative intent (CC-score 0). Median peritoneal cancer index (PCI) was 6 (IQR 3-11) and 75% of patients had preoperative chemotherapy. Median overall and disease-free survival of the cohort was 46 months (CI 39.5-52.49) and 12 months (CI 11.04-12.96). After a median follow-up time of 22 months, disease recurrence was detected in  $n=304$  (70.2%) patients, presenting as solitary hematogenous recurrence in  $n=103$  (38.0%), isolated peritoneal recurrence in  $n=109$  (40.2%) and mixed recurrence in  $n=59$  (21.8%) patients. Recurrence involving the peritoneum was associated with a worse outcome compared to patients with recurrence to the liver or lung (35 vs. 43 months, HR 1.50,  $p=0.029$ ). On multivariate regression analysis, PCI  $> 7$  (OR 2.44,  $p=0.028$ ), positive nodal stage of the primary (OR 4.10,  $p=0.009$ ) and RAS mutational status (OR 3.60,  $p=0.002$ ) were identified as predictive factors for recurrence in the peritoneum. Hepatic recurrence was associated with the localization of the primary tumor in the right colon.

**Conclusion:** Recurrence rates after CRS/HIPEC for PM are high and disease recurrence to the peritoneum impairs survival outcomes. Together with the disease load (PCI), tumor biology (primary nodal status, RAS mutational status) has a major impact on the localization of recurrent disease.

## Lower gastrointestinal tract

### Accuracy of radiological rectal cancer restaging after chemoradiotherapy

A. Kohler, B. Oberli, D. Candinas, L. Brügger, P. Studer

Department of Visceral Surgery and Medicine, Inselspital, University Hospital of Bern, University of Bern, Bern, Switzerland

**Objective:** Patients with rectal cancer and complete response to chemoradiotherapy (CRT) can be treated with the aim of organ preservation by applying a watch and wait strategy. However, if secondary radical surgery is needed due to cancer recurrence, this may be associated with an increased complication rate or even worse prognosis.

Therefore, restaging after CRT is of paramount importance to decide whether organ preservation protocols can be applied. This study aims to assess the accuracy of radiological restaging after CRT in a cohort of patients undergoing neoadjuvant treatment followed by oncological rectal resection for cancer.

**Methods:** Patients undergoing surgery for rectal cancer after CRT at our institution prior to the implementation of an organ preservation program were analyzed retrospectively. For all patients radiological T and N restaging by MRI after CRT but prior to surgery was compared to final pathological T and N staging. The rates of over- and understaging and sensitivity for radiological prediction of complete response were calculated.

**Results:** 64 patients (mean age 65 years, 72% male) undergoing treatment for rectal cancer between 2013 and 2017 were analyzed. Radiological T stage after CRT was underestimated in 17% (11/64), correct in 45% (29/64) and overestimated in 38% (24/64) of patients. Radiological N stage was underestimated in 17% (11/64), correct in 58% (37/64) and overestimated in 25% (16/64) of patients. Five patients out of 65 patients (7.7%) showed pathological complete response after CRT. Radiologically, complete response was described in only one of these five patients (sensitivity for complete response 20%). In none of the patients complete response was described by mistake.

**Conclusion:** Radiological assessment after CRT resulted in the correct tumor and nodal stage in about half of the examined patients. Overestimation of T and N stage was more frequent than underestimation, this is most probably due to remaining scar tissue after CRT. No patient was incorrectly staged as T0 or N0. Pathological complete response could be predicted correctly in only one of five patients. Therefore, clinical staging by digital rectal examination and endoscopy remains very important in the evaluation of rectal cancer after CRT. Further, histological or molecular markers are needed to better predict response to CRT and to identify patients that qualify for organ preservation.

### Circulating tumor DNA exposure in peripheral blood using a novel process: early results of a liquid biopsy feasibility study

F. Ris<sup>1</sup>, M. Hellan<sup>2</sup>, J. Ouellette<sup>2</sup>, T. Koessler<sup>3</sup>, N. C. Buchs<sup>1</sup>, L. Buehler<sup>1</sup>, F. Triponez<sup>1</sup>, C. Toso<sup>1</sup>

<sup>1</sup>Department of Surgery, Geneva University Hospitals, Geneva, Switzerland, <sup>2</sup>Department of Surgery, State Wright University, Dayton, USA, <sup>3</sup>Oncology, Geneva University Hospitals, Geneva, Switzerland

**Objective:** Standard screening recommendations are available for only a few cancers and most malignancies are discovered through incidental findings or after the presentation of symptoms. Early detection represents a potent solution towards higher rates of surgical resections with curative intent and should increase overall treatment success. Previous research has shown that analyses of circulating tumor DNA in the blood (liquid biopsy) could lower the threshold for cancer discovery before and after initial treatment.

**Methods:** 10 ml of peripheral blood was drawn from newly diagnosed patients with pancreatic or colorectal cancer, and a control cohort without known malignancy. DNA was extracted through a custom DNA extraction protocol using Qiagen circulating free nucleic acid extraction kits with 4 ml of plasma. Optimized next generation sequencing (NGS) was applied to detect elevations of pre-selected mutations that have been described to be associated with cancer. Raw data was analyzed using 2 different machine learning methods: Method 1 used 16 initial samples to train algorithms that were then applied in a blinded fashion to 24 additional samples. Method 2 searched for cancer vs. healthy patterns after unmasking the clinical data in all 40 samples.

**Results:** The pancreatic cancer cohort included 1 patient with early intra-ductal carcinoma, 1 patient with stage II, 1 patient with stage IV and 2 patients with stage III disease. The colorectal cancer group consisted of 1 patient with stage I, 3 patients with stage II and 2 patients with stage III disease. 29 participants did not have a cancer diagnosis. The predictive machine learning algorithm performed at an overall accuracy of 0.9583, with a specificity of 1 and a sensitivity of 0.74. After unmasking the clinical diagnoses, machine learning showed 100% accuracy in distinguishing cancer patterns from controls.

**Conclusion:** Despite a very limited learning set, this new approach combining custom DNA extraction, ONGS and machine learning appears to deliver a clinically relevant accuracy for detecting colorectal and pancreatic cancer. As such, it might be a useful tool for early cancer detection for diagnosis, assessing treatment response including a liquid post-operative pathology, and monitoring disease recurrence through blood samples. However, more clinical data is needed to further determine the precise role of this approach.

#### Double blind randomized placebo - controlled trial of perianal block for postoperative analgesia in proctology

N. Rotigliano<sup>1</sup>, I. Füglistaler<sup>1</sup>, M. O. Guenin<sup>1</sup>, D. Freiermuth<sup>2</sup>, G. B. Dursunoglu<sup>1</sup>, M. von Flüe<sup>1</sup>, D. C. Steinemann<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Clarunis - University Abdominal Center, Basel, Switzerland, <sup>2</sup>Department of Anaesthesiology, St. Claraspital, Basel, Switzerland

**Objective:** Safety and short-term efficacy of perianal block as sole anesthesia in proctologic interventions have been demonstrated before. However, in Switzerland, perianal block is more frequently used as an adjunct to general or regional anesthesia for postoperative pain control. This study aims to evaluate the influence of adjunct perianal block for prolonged pain control after proctologic surgery.

**Methods:** 138 patients undergoing surgery for hemorrhoids, anal fistula or anal fissures were randomized in two equal groups. The intervention group received 40 milliliters of 0.5% ropivacaine solution injected in each perianal quadrant. The control group received perianal injection of 40 milliliters of 0.9% NaCl solution. Patients, surgeons and assessors were blinded for the group allocation. Pain was assessed using a numeric rating scale (NRS; 0 = no pain, 10 = strongest pain) at 1, 2, 3, 12, and 24 hours after surgery. The need for opiates was monitored in the first 24 hours and calculated in intravenous morphine equivalents. Primary outcome was pain 24 hours after surgery.

**Results:** Patients were allocated to perianal ropivacaine or placebo as an adjunct to general (n = 41 and 43) or spinal anesthesia (28 and 26; p = 0.86) between february and december 2018. Within the groups surgery for hemorrhoids (42 and 40), fistulas (22 and 24), and fissures (5 each) were equally distributed (p = 0.93). Mean NRS was lower in patients that received perianal block with ropivacaine (1.2 ± 0.2) compared to placebo (1.8 ± 0.3; p = 0.042) 24 hours after surgery. Lower NRS were also found 1 hour (1.1 ± 0.2 and 2.0 ± 0.3; p = 0.01), 2 hours (0.8 ± 0.2 and 1.3 ± 0.2; p = 0.03), 3 hours (0.8 ± 0.18 and 1.3 ± 0.2; p = 0.04), and 12 hours (0.9 ± 0.2 and 1.6 ± 0.2; p = 0.01) after surgery in the intervention group compared to placebo. The need for opiates was reduced in the ropivacaine (3.1 ± 0.6 mg) versus the placebo group (5.0 ± 0.7 mg, p = 0.04).

**Conclusion:** Perianal block as an adjunct to general or spinal anesthesia in proctology reduces postoperative pain and analgesia requirements even beyond the duration of action of ropivacaine. Considering the ongoing trend towards ambulatory surgery perianal block may gain even more attraction.

#### Fascin - 1 expression in colorectal cancer: is there a high risk group of patients prone to metastasis already in early stage disease?

A. Tampakis<sup>1</sup>, E. C. Tampaki<sup>2</sup>, A. Nonni<sup>3</sup>, K. Kontzoglou<sup>2</sup>, G. Tsourouflis<sup>2</sup>, E. Patsoiris<sup>3</sup>, G. Kouraklis<sup>2</sup>

<sup>1</sup>Department of Visceral Surgery, Clarunis - University Abdominal Center, Basel, Switzerland, <sup>2</sup>2nd Department of Propedeutic Surgery, Laiko General Hospital, University of Athens, Athens, Greece, <sup>3</sup>Institute of Pathology, Laiko General Hospital, University of Athens, Athens, Greece

**Objective:** Fascin is a stem cell marker that regulates adhesion dynamics and stabilizes cell protrusion such as filopodia. In human cancer, fascin expression has been correlated with malignant tumors exhibiting aggressive

clinical features. The aim of the present study was to assess the expression patterns of fascin in colorectal cancer and to determine its prognostic significance.

**Methods:** A validated assay comprised of 111 specimens of patients with primary resectable colorectal cancer, were assessed via immunohistochemistry for the expression of fascin-1. Cut-off points to define levels of expression of fascin-1 were determined by using Roc-curve and X-tile. Results were correlated with clinicopathological characteristics and survival data.

**Results:** Fascin-1 was strongly expressed in the cytoplasm of the colorectal cancer cells and in endothelial cells of tumor blood vessels. High fascin-1 expression was associated with progressive T stage (p = 0.007), the presence of lymph nodes (p < 0.001) and distant metastasis (p = 0.002), low grade differentiation (p = 0.002), vascular invasion (p < 0.001). Patients exhibiting high expression of fascin-1 demonstrated a significantly worse 3-year progression free survival (20% vs 75%, p < 0.001) and 5-year overall survival (13.3% vs 80%, p < 0.001). Subgroup analysis comprised of patients with UICC stage I and II only, demonstrated as well a significantly worse 5-year overall survival (48% vs 93.5%, p = 0.007) when fascin-1 expression exists. High fascin-1 expression was confirmed in the multivariate analysis using Cox proportional hazard models as an independent prognostic factor of worse progression free survival (HR; 0.290, 95% CI = 0.118-0.714) and poor overall survival (HR; 0.256, 95% CI = 0.082-0.800).

**Conclusion:** High fascin-1 expression in colorectal cancer is an independent negative prognostic factor for progression free and overall survival. Fascin-1 could possibly represent a target for immunotherapy or could be utilized to identify patients at high risk to develop disease recurrence and/or metastasis already in early stage disease.

#### High risk of underlying neoplasia in complicated appendicitis

A. Litchinko, A. Miftaroski, B. Egger

Department of Surgery, HFR Fribourg – Cantonal Hospital, Fribourg, Switzerland

**Objective:** Appendectomy is one of the most frequent routine operation performed nowadays. At histological examination of the resected specimens, neoplasia of the appendix is found in 1-2%. Recent studies have demonstrated that the risk of neoplasia in patients with complicated appendicitis, abscess formation and > 40 years of age is up to 29%.

**Methods:** We present here a retrospective study of data out of a prospective database with 20 adult patient undergoing interval appendectomies after drainage for complicated appendicitis with abscess formation during a 11-year period at a single regional hospital. In a previous study, published in 2017, we presented a cohort of 15 patients with complicated appendicitis and abscess formation undergoing a two-step procedure with initial drainage and then interval appendectomy. In this study we already underlined the high risk of an underlying malignant neoplasia in this population. In the present study, 5 more patients have been added to our already published cohort and data evaluated again.

**Results:** 20 patients were treated for complicated appendicitis with drainage and undergoing then interval appendectomy. Among them, 2 patients (10%) were diagnosed with malignant neoplasia. Considering only patients > 40 years of age, this value rises up to 15%.

**Conclusion:** In summary, our results are consistent with recent findings in the literature. Despite the persistent controversy what concerns the treatment of complicated appendicitis, this study strongly suggest that interval appendectomy should be performed shortly after conservative management (drainage) due to the high risk of a possible underlying malignant neoplasia; especially in patients > 40 years of age.

### Impact of geography of disease burden, surgical approaches and recurrence in global pilonidal sinus disease. A Swiss perspective

A. Orlik<sup>1</sup>, D. Doll<sup>2</sup>, P. Kauf<sup>3</sup>, M. Schmid<sup>3</sup>, M. Lüdi<sup>4</sup>, V. Stauffer<sup>5</sup>

<sup>1</sup>Inselspital, University Hospital of Bern, Bern, Switzerland, <sup>2</sup>Hannover University, St. Marien-Krankenhaus Vechta, Hannover, Germany, <sup>3</sup>Biomedical Statistics Prognosis AG, Zurich, Switzerland, <sup>4</sup>Department of Anesthesiology, Inselspital, University Hospital of Bern, Bern, Switzerland, <sup>5</sup>Hospitals Sonnenhof and Lindenhof, Bern, Switzerland

**Objective:** The incidence of pilonidal sinus disease (PSD) is rising both in Switzerland and globally. Very recently we showed in a meta- and merged-data analysis of > 700 studies that recurrence rates in PSD depend on specific surgical procedures and follow-up time. Geography and respective settings have been shown to affect a manifold of diseases. However, the global distribution of surgical approaches and the respective recurrence rates have never been studied in PSD. We therefore aimed at studying the impact of geographic distribution of surgical approaches to treat PSD and respective recurrence rates.

**Methods:** Reviewing 6,143 publications from the years 1833 to 2017 in English, French, German, Italian, and Spanish language, we identified 740 including data on geography of origin, recurrence rate, and follow-up time and > 80'000 patients. We then assessed data in the manner of a merged data analysis for 12, 24, 60 and 120 months with linear interpolation to discover the impact of geographic distribution of surgical approaches and respective recurrence rates.

**Results:** Our data provide comprehensive insights for all approaches in all geographic regions. The Limberg and Dufourmental approach (incl. modifications such as rhomboid flap, teardrop flap and z-plasty) for example showed globally the lowest recurrence rate (0.3% after 1 year, 95% CI 0.2-0.4%). While, for example a primary open strategy shows 0.0% recurrence after 12 months in Italy, rates are significantly higher in the U.S. (4.3%, 95% CI 3.6-5.1). Similarly, PSD recurs in the "Pit Picking" approach in 21.0% (95% CI 16.7-25.3) after 12 months in Germany but in only 0.4% (95% CI 0.0-1.0) in Turkey.

**Conclusion:** Our extensive data analyzed show that recurrence rates in PSD not only depend on therapeutic approaches and follow-up time but also on the country and respective settings. This shows that geography impacts surgical approaches and recurrence in PSD patients. Additionally, our data reveals global training opportunities considering specific surgical approaches.

### Interleukin - 22 producing T cells promote neutrophil recruitment and better clinical outcome in human colorectal cancer

N. Tosti<sup>1</sup>, E. Cremonesi<sup>2</sup>, V. Governà<sup>2</sup>, V. Kancherla<sup>1</sup>, M. Coto<sup>1</sup>, F. Amicarella<sup>2</sup>, B. Weixler<sup>3</sup>, S. Däster<sup>4</sup>, G. Sconocchia<sup>5</sup>, G. C. Spagnoli<sup>2,5</sup>, L. Tornillo<sup>1</sup>, L. M. Terracciano<sup>1</sup>, S. Eppenberger-Castori<sup>1</sup>, C. Ng<sup>1,2</sup>, S. Pisuoglio<sup>1,6</sup>, M. von Flüe<sup>6</sup>, G. Iezzi<sup>2,7</sup>, R. A. Droeser<sup>4</sup>

<sup>1</sup>Molecular Pathology Unit, Institute of Pathology, Basel, Switzerland, <sup>2</sup>Department of Biomedicine, University Hospital Basel, Basel, Switzerland, <sup>3</sup>Clinic for General, Visceral and Vascular Surgery, Charité University Medical Center, Berlin, Germany, <sup>4</sup>Department of Surgery, University Hospital Basel, Basel, Switzerland, <sup>5</sup>National Research Council, Institute of Translational Pharmacology, Rome, Italy, <sup>6</sup>Department of Biomedicine, Visceral Surgery Research Laboratory, Basel, Switzerland, <sup>7</sup>Department of Surgery, Cantonal Hospital Lugano and University Svizzera Italiana, Lugano, Switzerland

**Objective:** T cell infiltration has been recognized to significantly impact clinical outcome in human colorectal cancer (CRC). Interleukin 22 (IL-22), a cytokine secreted by IL-17-producing CD4+ T cells (Th17) is known to play a crucial role in inflammatory bowel disease and has been shown to have protumorigenic activity in mouse tumor models. However, its role in human CRC is still unclear. As consequence, we evaluated the prognostic and functional impact of IL-22 producing cells in human CRC in this follow-up study.

**Methods:** In order to evaluate IL-22 expression in CRC, immunohistochemistry was performed on a well-characterized TMA including 425 cases of Primary CRC. Moreover, phenotypic characterization of IL-22 positive cells was assessed by flow cytometry of single cell suspensions. Next, in vitro experiments were done to further elucidate the effects of IL-22 on CRC cells.

**Results:** IL-22 positive cells were detected both within tumor cells and tumor infiltrating immune cells. Whereas, IL-22 expression by tumor cells did not

affect prognosis, densities of IL-22 positive immune cells were found to be significantly associated with early T stage and MMR-deficient microsatellite stability. Importantly, IL-22 expression by CRC infiltrating immune cells was predictive of improved overall survival independent of known prognostic factors such as T stage, N stage, tumor grade, vascular invasion, tumor border configuration and MMR status. Phenotypic characterization of IL-22 positive cells revealed that they consist mainly of polyfunctional CD4+ and CD8+ T cells, also producing IL-17 and IFN- $\gamma$ . Moreover, in vitro experiments showed a new role of IL-22 in stimulating CRC cells to release chemokines promoting neutrophils recruitment.

**Conclusion:** In conclusion, our data suggest that by stimulating production of neutrophil recruiting chemokines in tumor cells, IL-22-producing T cells might favor CRC infiltration by neutrophils, thus contributing to a more favorable clinical outcome.

### Is there a relation between adequate nurse staff and the incidence of infectious complications in patients undergoing colorectal surgery within an ERAS program?

S. Kasmi<sup>1</sup>, M. Schäfer<sup>1</sup>, M. Hübner<sup>1</sup>, N. Demartines<sup>1</sup>, D. Hahnloser<sup>1</sup>, M.-O. Sauvain<sup>2,1</sup>

<sup>1</sup>Department of Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>2</sup>Department of Surgery, Hospital of Neuchâtel, Neuchâtel, Switzerland

**Objective:** Colorectal surgery is still associated with an increased postoperative complication rate. The role of an adequate nurse staffing to provide an optimal patient care has not been yet assessed. This retrospective study aimed to analyze the relationship between the estimated nurse workload and the occurrence of postoperative complications of patients undergoing colorectal surgery within an ERAS program.

**Methods:** Retrospective analysis of all patients undergoing elective and emergency colorectal surgery from 01/2014 to 12/2016 within our ERAS program. Patient's characteristics, and complication rates were assessed. Nurse workload for individual patients was calculated by using the *Projet de Recherche en Nursing program (PRN)*. It assigns points to each patient according to the type of care needed. The sum of all PRN on a ward provides an estimation of the number of nurses or equivalent full-time job required to deliver this amount of care. During the period studied, the mean real/required PRN rate was calculated (81.04%). Based on this mean PRN, patients were dichotomized. Overall, infectious, wound and urinary tract infections were assessed as endpoints. Standard statistical testing was used, a p value < 0.05 was considered statistically significant.

**Results:** There were 895 patients (m/f 492/403) with a mean age of 63 years included. There were 276 (31%) open surgeries, 579 (65%) laparoscopic operations, and 40 conversions (4.4%). The overall complication rate was 50.5%, while infectious complications, wound infections, urinary tract infections and surgical complications occurred in 20.5%, 8.6%, 5.1%, and 25.3%, respectively. By comparing the two overall groups (PRN > 81.04 vs. PRN < 81.04), there were no statistically significant differences regarding all types of assessed complications. The subgroup of patients with open surgeries revealed a statistically significant higher rate of overall (p = 0.0002) and infectious (p = 0.0260) complications if the PRN was < 81.04. Only the overall complication rate after laparoscopic surgery was significantly increased (p = 0.0150) in case of understaffing.

**Conclusion:** Understaffing the nurses was associated with increased overall and infectious complication rates in patients undergoing open colorectal surgery. The PRN system can be used to reliably predict the correct workload for such patients.

### Left lower transverse incision versus Pfannenstiel - Kerr incision for laparoscopic specimen extraction in patients with recurrent sigmoid diverticulitis: a comparative study of two surgical techniques

N. Varathan, N. Rotigliano, D.C. Steinemann, I. Füglistaler, M. Von Flüe, A. Posabella

Department of Surgery, St. Claraspital, Basel, Switzerland

**Objective:** The aim of this study is to compare the incidence of incisional hernias and wound infections in patients that underwent an elective laparoscopic resection for recurrent sigmoid diverticulitis with specimen extraction through a left lower transverse incision or a Pfannenstiel-Kerr incision.

**Methods:** Two hundred sixty-nine patients underwent elective laparoscopic sigmoidectomy between January 2014 and December 2017. Of those patients with specimen extraction through a left lower transverse incision (LLT) and patients with specimen extraction through a Pfannenstiel-K incision (P-K) were matched 1:1 controlling for age, sex, comorbidities, and previous abdominal surgery. The baseline data and the results were compared using Fisher's exact test. Minimum follow-up was 12 months.

**Results:** After matching, 77 patients in the LLT group and 77 patients in the P-K group were found to be equivalent regarding above mentioned clinical-demographic characteristics. No patients in the P-K group developed an incisional hernia compared to 10 patients (13%) in LLT group ( $p=0.0014$ ). All of these patients needed hernia repair with a mesh implantation. In the P-K group the wound was protected using an Alexis® wound protector in 65%, V-drape® in 14%, or not protected in 21%. In the LLT group the wound was protected using an Alexis® wound protector in 14%, V-drape® in 22%, or not protected in 64%. The rate of wound infections was 1/77 in the P-K group and 0/77 in the LLT group ( $p=1.0$ ).

**Conclusion:** The Pfannenstiel-Kerr incision may be the preferred extraction site compared to the left lower transverse incision given the significant reduction of the risk of incisional hernias. No difference was shown in the incidence of wound infections, regardless of the use of an intraoperative wound protector.

### Longterm outcome of anal fistula - a retrospective study

C. Andreou<sup>1</sup>, J. Zeindler<sup>1</sup>, D. Oertli<sup>2</sup>, H. Misteli<sup>3</sup>

<sup>1</sup>Department of Visceral Surgery, Clarunis - University Abdominal Center, Basel, Switzerland, <sup>2</sup>Department of Visceral Surgery, University Hospital Basel, Basel, Switzerland, <sup>3</sup>Department of Visceral Surgery, Hospital of Uster, Uster, Switzerland

**Objective:** This retrospective observational study analyses the outcomes of patients who underwent surgery for anal fistula at a single center.

**Methods:** During a time period of 9 years (01/2005-05/2013) all patients with anal fistula were included. Baseline characteristics, details of presentation, fistula anatomy, type of surgery, post-surgical outcomes and follow-up data were collected. Exclusion criteria were chronic inflammatory bowel disease and previous operation of anal or rectal cancer. The primary endpoints were long-term closure rate and recurrence rate (RR) after 2 years. Secondary endpoints were persistent pain after 2 years, postoperative complications and continence status.

**Results:** A total of 65 patients (52 males, 13 females) with a mean age of 49.7 years were included. The total amount of analyzed operations was 93 which were performed in 78 fistulae. Seventy percent of the performed operations were fistulotomies ( $n=65$ ), 14% mucosal advancement flaps ( $n=13$ ), 8% anal fistula plugs ( $n=7$ ) and 8% cutting-setons ( $n=8$ ). The mean follow up was 80.5 months. Healing was achieved in 84% with a total RR of 16% ( $n=15$ ). The highest RR was seen in anal fistula plug with 57%. No recurrence was observed in the total of 8 cutting-seton procedures. For mucosal advancement flap the RR was 23% and for fistulotomy 12%. Detailed analyses of fistulotomy patients show different RR in high fistulae with 28%, comparing to low fistulae with a RR of 6%. Furthermore, 80% of the recurrent high fistulae were not previously treated with a seton. Postoperative infection with abscess but without progression into a recurrent fistula, was seen in 7 of the 65 fistulotomies (complication rate of 11%). For all the different procedures there was no persistent postoperative pain nor incontinence in the long-term follow up.

**Conclusion:** Despite of all the new innovative and minimal invasive operations for the treatment of anal fistula, the healing rate does not show similar results when compared with traditional techniques. In addition, even though the use of cutting-seton is discussed as an outdated technique, the right use

in respect of its limitations can be a helpful and easy operation with good results even for the feared complication of incontinence. Further trials are needed to elucidate the efficacy and potential benefit of each technique available in anal fistula treatment.

### Long - term quality of life is similar in operated and conservatively managed patients with diverticular disease

D. W. Stimpfle, E. Gerns, U. Zingg

Department of Surgery, Limmattal Hospital, Schlieren, Switzerland

**Objective:** There is substantial debate whether elective surgery in diverticular disease is indicated at any point. Sceptics argue, among other things, that morbidity is high and quality of life is impaired after surgery. The aim of this study was to analyse the long-term quality of life of operated patients with comparison to a conservatively managed cohort.

**Methods:** All patients treated for diverticular disease with elective surgery or conservatively with antibiotics from 2008-2015 were assessed. Patients were contacted by phone and invited for a clinical assessment. Patients' characteristics, long-term complications and Gastrointestinal Quality of Life (GIQLI) score were collected. Surgery was indicated if two or more acute attacks occurred, patients suffered from abscess or stenosis, were young or immunocompromised, according to the 2000/2006 ASCRS Guidelines.

**Results:** In total 150 patients agreed to participate. 119 patients were operated (114 laparoscopically, 5 open) and 31 treated conservatively. Age, gender, Charlson comorbidity index, medication use and mobility were comparable. In the operated group the number of attacks ( $p=0.002$ ) and the Hinchey score ( $p=0.005$ ) were significantly higher. Median of GIQLI Score was 123 in non-operative patients and 119 in operative patients, respectively ( $p=0.308$ ). Number of attacks, Hinchey score, and severity of diverticular disease in colonoscopy had no significant influence on the GIQLI score. Overall short-term surgical morbidity in the surgery group was 22.7%, with an anastomotic leak rate of 3.4%. Overall long term complications were significantly higher in the operated group [45 (37.8%) vs. 5 (16.1%),  $p=0.023$ ]. 11 patients (9.2%) in the operated group and 4 (12.9%) in the non-operated group had anamnestically recurrent attacks ( $p=0.514$ ). Impaired urinary and sexual function, respectively, occurred in 7 (5.9%) and 11 (9.2%) patients in the surgery group, none in the conservative group. 9 operated patients (7.6%) developed incisional hernia, 5 (4.2%) anastomotic stricture and 1 (0.8%) a small bowel obstruction.

**Conclusion:** Despite relevant short and long term morbidity, patients undergoing resection for diverticular disease reach similar GIQLI quality of life scores compared to conservatively treated patients. However, the surgery must be indicated with care and awareness of a substantial morbidity in the long term.

### Nestin and CD34 expression in colorectal cancer promotes a favorable immune response and consequently a beneficial overall survival

A. Tampakis<sup>1</sup>, B. Weixler<sup>2</sup>, S. Rast<sup>1</sup>, E. C. Tampaki<sup>3</sup>, E. Cremonesi<sup>4</sup>, N. Tosti<sup>1</sup>, C. Kettelhack<sup>1</sup>, C. Ng<sup>4</sup>, S. Piscuoglio<sup>5</sup>, T. Delko<sup>1</sup>, S. D. Soysal<sup>1</sup>, G. C. Spagnoli<sup>4</sup>, U. von Holzen<sup>6</sup>, S. Eppenberger-Castori<sup>5</sup>, L. Terracciano<sup>5</sup>, L. Tornillo<sup>5</sup>, M. von Flüe<sup>1</sup>, S. Däster<sup>1</sup>, R. A. Droeser<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Clarunis - University Abdominal Center, Basel, Switzerland, <sup>2</sup>Clinic for General, Visceral and Vascular Surgery, Charité - University Medical Center Berlin, Berlin, Germany, <sup>3</sup>2nd Department of Propedeutic Surgery, Laiko General Hospital, University of Athens, Athens, Greece, <sup>4</sup>Department of Biomedicine, University Hospital Basel, Basel, Switzerland, <sup>5</sup>Institute of Pathology, University Hospital Basel, Basel, Switzerland, <sup>6</sup>Department of Surgery, Gosben Center for Cancer Care, Indiana University School of Medicine South Bend, Gosben, USA

**Objective:** Nestin, represents a class VI intermediate filament protein of the cytoskeleton and cells expressing nestin harbor properties of progenitor/stem cells. CD34 is a transmembrane phosphoglycoprotein, known as a marker of hematopoietic progenitor and stem cells. Both molecules have been implicated in processes such as tissue injury and malignant transformation. In colorectal cancer (CRC) they have been used as neoangiogenesis markers.

The aim of this study was to evaluate expression patterns of nestin and CD34 in CRC and to determine their clinical significance.

**Methods:** A clinically annotated tissue microarray including 599 patients with CRC was analyzed by immunohistochemistry to investigate expression patterns of nestin and CD34. Results were correlated with clinicopathological characteristics and survival data. Nestin and CD34 gene expression was analyzed in 39 freshly excised CRC specimens via RT-PCR (reverse transcription PCR). Associations of nestin and CD34 with a panel of cytokines and chemokines related to hypoxia and immune response processes were assessed by RT-PCR and TCGA analysis.

**Results:** Expression of nestin and CD34 was observed only in cells of the tumor stroma. High expression of both markers was correlated with T1 and T2 tumors ( $p=0.020$ ) as well as with lower vascular invasion ( $p<0.001$ ). Patients displaying simultaneously high expression of nestin and CD34 demonstrated a beneficial 5-year overall survival (65%; 95%CI=55-73 vs 45% 95%CI=37-53) independent of other clinicopathological characteristics (HR: 0.67; 95%CI=0.46-0.96;  $p=0.031$ ). After performing RT-PCR nestin and CD34 presented a moderate to strong correlation ( $r=0.37-0.78$ ,  $p<0.02$ ) for the following markers; HIF-1 $\alpha$ , CD4, CD8, FOXP3, IRF1, GATA3, CCL2, CCL3, CXCL12 and CCL21. Nevertheless, TCGA analysis demonstrated up-regulation of only CCL21, CD4, CXCL12 and FOXP3 when combined expression of both markers exists.

**Conclusion:** Nestin and CD34 expression in colorectal cancer promotes a favorable immune response and predicts independently a beneficial overall survival.

#### Outcomes of 97 consecutive transanal total mesorectal excisions for low rectal cancer

S. Gloor<sup>1,2</sup>, R. Troller<sup>1,3</sup>, F. Glieder<sup>1</sup>, H. Gelpke<sup>1</sup>, S. Breitenstein<sup>1</sup>, M. Adamina<sup>1</sup>

<sup>1</sup>Department of Visceral and Thoracic Surgery, Cantonal Hospital Winterthur, Winterthur, Switzerland, <sup>2</sup>Department of Surgery, GZO Hospital Wetzikon, Wetzikon, Switzerland, <sup>3</sup>Department of Colorectal Surgery, Royal Free Hospital London, London, United Kingdom

**Objective:** Transanal total mesorectal excision (taTME) is an alternative to conventional total mesorectal excision owing to its reported superior ability to achieve clear distal and circumferential resection margins in low rectal cancers.

**Methods:** Consecutive patients with low rectal cancer treated at a single centre by taTME were included in a prospective cohort study. Patients who qualified for a partial mesorectal excision (PME) were excluded and treated by conventional laparoscopic PME. Perioperative and short-term oncologic outcomes were measured along regular clinic visits and the results were reported as median and interquartile range (IQR).

**Results:** 97 patients with a low rectal cancer (6.5 cm to anal verge, IQR 5-9) underwent a taTME between Feb 2013 and December 2018. Age and body mass index were 65.5 years (IQR 57-76) and 26 kg/m<sup>2</sup> (IQR 22.8-29). There were 71 males and 26 females. 64 (62%) patients had neoadjuvant radiochemotherapy. Surgery time was 350 minutes (IQR 306-422), including an ileostomy in all patients. Performing taTME in a 2-team technique saved 79.5 minutes or 19.6% operating time ( $p=0.009$ , t-test one-team ( $n=39$ , 406 minutes, IQR 344-465) vs. 2-team ( $n=58$ , 326.5 minutes, IQR 287-369)). Dissection of the mesorectum was excellent (91.8% Quirke 3) and all distal and circumferential margins were clear. Median T stage was 3 (IQR 2-3). 35 patients had lymphnode metastases for a median number of retrieved nodes of 26 (IQR 20-38). Cumulative 30-day morbidity amounted to 18.6% minor complications (Dindo Clavien II) and 26.8% major complications (Dindo Clavien III-V), including 10 anastomotic leaks (10.3%) and 3 reoperations (3.1%). Most of the leaks could be managed endoscopically and the ileostomy reversed at last. Median length of hospital stay was 10 days (IQR 8-14).

**Conclusion:** Transanal total mesorectal excision allows good surgical and oncologic quality to the expenses of a reasonable surgery time and morbidity.

#### Primary anastomosis vs Hartmann procedure for Hinchey III and IV complicated diverticulitis. A single-center experience reflecting current trends.

I. Facile, R. Rosenberg, R. Galli

Department of Surgery, Cantonal Hospital Baselland, Liestal, Switzerland

**Objective:** This study was designed to assess management of patients presenting with perforated diverticulitis (Hinchey stages III and IV) in a regional tertiary referral center comparing patients' characteristics affecting choice of procedure (primary anastomosis "PA" or Hartmann procedure "HP") and postoperative outcomes.

**Methods:** Retrospective review of all patients operated for a Hinchey III and IV diverticulitis in our institution between 2015 and 2018 was performed. 33 Patients underwent PA with or without defunctioning ileostomy and 33 patients had a HP. Basic patients' demographics, comorbidities, P-Possum score, ASA classification, operating time and outcomes (mortality, complications according to Clavien-Dindo classification, stoma reversal, length of hospital stay and ICU stay) were analyzed.

**Results:** Patients undergoing HP were older ( $75 \pm 11.9$  vs  $62 \pm 11.6$  years,  $p<0.001$ ), had a higher number of Hinchey IV diverticulitis (45% vs 9%,  $p=0.002$ ), higher rate of preoperative renal failure (51% vs 3%,  $p<0.001$ ), higher ASA classification  $\geq 3$  (82% vs 57%,  $p=0.032$ ), higher estimated morbidity ( $83 \pm 13.6\%$  vs  $66 \pm 12.2\%$ ,  $p<0.001$ ) and mortality ( $23.1 \pm 20.9\%$  vs  $6.36 \pm 5.5\%$ ,  $p<0.001$ ) according to P-Possum Score, and longer hospital stay ( $19.7 \pm 17$  vs  $12.8 \pm 5.1$  days,  $p=0.014$ ) and ICU stay ( $6 \pm 8.3$  vs  $1.3 \pm 2$  days,  $p=0.015$ ). Operating time was shorter ( $161 \pm 61$  vs  $194 \pm 56$  min,  $p=0.015$ ). No significant differences were found for comorbidities such as immunosuppression (33% vs 15%,  $p=0.142$ ), diabetes (24% vs 6%,  $p=0.082$ ) or obesity (BMI 26.1 vs 26.1,  $p=0.472$ ). Postoperative outcome didn't differ significantly between PA and HP (severe complications  $> IIIa$  33% vs 15%,  $p=0.085$ ; mortality within 30 days 18% vs 3%,  $p=0.0502$ ). Stoma reversal, when applicable, was more frequent after PA (92.3%) than after HP (37%).

**Conclusion:** This study confirms that HP is the preferred procedure for older patients and patients with severe comorbidities presenting with fecal peritonitis. As showed in the literature PA is a feasible and safe option in terms of morbidity and mortality rates, although a careful pre-operative selection and definition of high risk patients is warranted.

#### Primary tumour resection in patients with incurable colorectal cancer

C. Gingert<sup>1</sup>, C. Simillis<sup>2</sup>, E. Kalakouti<sup>2</sup>, T. Afxentiou<sup>3</sup>, D. Cunningham<sup>3</sup>, M. Adamina<sup>1</sup>, P. Tekkis<sup>4</sup>

<sup>1</sup>Department of Surgery, Cantonal Hospital Winterthur, Winterthur, Switzerland, <sup>2</sup>Department of Colorectal Surgery, Chelsea and Westminster Hospital NHS Trust, London, United Kingdom, <sup>3</sup>Department of Gastrointestinal Oncology, Royal Marsden Hospital, London, United Kingdom, <sup>4</sup>Department of Colorectal Surgery, Royal Marsden Hospital, London, United Kingdom

**Objective:** At diagnosis, about 1 in 4 patients with colorectal cancer present with synchronous metastases, which are unresectable in 75% of these patients. An important question which remains unanswered for those patients is whether the best treatment strategy is primary tumour resection (PTR) with chemotherapy, or immediate chemotherapy without PTR.

**Methods:** A systematic literature review and meta-analysis was performed to compare survival and adverse events in patients with incurable colorectal cancer undergoing PTR versus primary tumour intact (PTI), both including modern chemotherapy regimen. An inverse-variance random-effects model was used for the meta-analysis.

**Results:** 75 studies were included, reporting on 129'994 participants (82'951 PTR; 47'043 PTI). PTR increased overall survival (hazard ratio [HR] 0.58,  $P<0.0001$ ) by 7.5 months (mean difference [MD] 7.53 months,  $P<0.0001$ ) compared to PTI. PTR resulted in longer cancer-specific survival (HR 0.44,  $P<0.0001$ ; MD 10.01,  $P<0.0001$ ) and progression-free survival (HR 0.75,  $P<0.0001$ ; MD 1.70,  $P<0.0001$ ). PTR also improved overall survival during subgroup analysis of: patients receiving chemotherapy (HR 0.57,  $P<0.0001$ ; MD 7.27,  $P<0.0001$ ), patients receiving bevacizumab (HR 0.56,  $P=0.05$ ; MD 10.56,  $P=0.01$ ), elderly patients (HR 0.46,  $P<0.0001$ ; MD 8.72,  $P<0.0001$ ), asymptomatic patients (HR 0.66,  $P<0.0001$ ; MD 3.86,  $P=0.002$ ), studies

with propensity analysis (HR 0.62,  $P < 0.0001$ ; MD 5.68,  $P = 0.0003$ ). PTR had 4.5% perioperative mortality and 22.4% morbidity (major adverse events 10.2%, minor 18.5%, reoperation 2.5%, intraabdominal collection/sepsis 2.2%, anastomotic leak 1.6%). PTI was associated with 21.7% morbidity (obstruction 14.4%, anaemia 11.0%, haemorrhage 1.5%, perforation 0.6%, adverse events requiring surgery 15.8%). Non-resectional surgery resulted in 10.6% perioperative mortality and 21.7% morbidity (major 7.9%, minor 21.7%, reoperation 0.1%).

**Conclusion:** PTR in patients with incurable colorectal cancer results in an appreciable improvement of survival without a significant increase in overall complications. PTR should be considered by the multidisciplinary team on an individual patient basis.

#### Prognostic risk factor for surgical site infection in colon surgery

F. Frehner<sup>1</sup>, R. Rosenberg<sup>1</sup>, S. Lamm<sup>1</sup>, R. Galli<sup>1</sup>, J. Roth<sup>2</sup>, A. Widmer<sup>2</sup>

<sup>1</sup>Department of Surgery, Cantonal Hospital Baselland, Liestal, Switzerland,

<sup>2</sup>Department of Infectiology and Hospital Hygiene, University Hospital Basel, Basel, Switzerland

**Objective:** Colon surgery in Switzerland is associated with a surgical site infection (SSI) rate of 13.7% in 2017. SSIs prolong hospital stay and increase morbidity and mortality. The national center for infection prevention (Swissnoso) established a surveillance program and monitors postoperative surgical site infections. However, risk factors for SSI may differ between regions. Our aim was to identify prognostic risk factors which correlate with increased surgical site infections.

**Methods:** We analyzed the Swiss Noso data of all patients, which underwent colon surgery between October 2010 and July 2018 of three cantonal hospitals. Individual, surgical and hospital characteristics were identified and analyzed statistically.

**Results:** 1,391 colon surgeries were performed during the analyzed period. The overall rate of SSIs was 10.6%. Emergencies accounted for 38.5% of all interventions under study, with an associated mortality within 30 days of 3.8%. 66.4% of operations were performed in hospital A with a surgical site infection rate of 12.2%, 28.7% of operations in hospital B with a SSI rate of 6.5% and 5.0% of operations in hospital C with a SSI rate of 11.6%. Independent risk factors were age of patients with an adjusted hazard ratio (HR) of 1.02 ( $p > 0.001$ ; 95% CI: 1.016-1.023), BMI  $> 30 \text{ kg/m}^2$  with a HR 2.53 95% CI 1.28 – 5.00, hospital HR 1.45 with 95% CI 1.19-1.77, type of surgery (emergency vs. elective) HR 0.51 with a 95% CI 0.31 – 0.84 and year of intervention HR 1.24 (95% CI 1.09-1.40). Antimicrobial prophylaxis  $< 60$  minutes prior to incision, NNIS risk index, duration of surgery and gender were not statistically different.

**Conclusion:** Analyses in addition to the overall report of Swissnoso provides additional information on potential risk factors for focusing preventive strategies on specific factors not obvious in the national overall analyses.

#### Reconstruction or amputation of very low rectal cancers? The intraoperative pathological assessment of the TME-specimen by expert pathologists provides important information for the decision

J. Watson, A. Rickenbacher, K. Horisberger, D. Cabalzar, M. Turina

Department of Visceral and Transplant Surgery, University Hospital Zurich, Zurich, Switzerland

**Objective:** In patients with low rectal cancer the intraoperative decision for reconstruction or amputation can be challenging. The macroscopic distance of the tumor to the resection margin may be difficult to interpret and intraoperative frozen sections of biopsies may not provide enough information. The goal of the present study was to evaluate the value of intraoperative assessment of the TME specimen during an interruption of the operation.

**Methods:** The intraoperative strategy of eight patients with a low rectal cancer was evaluated. In all cases an intraoperative pathological assessment of the TME-specimen by an expert pathologist together with the surgeon was performed. Assessment of the distance of the tumor to the resection margin was evaluated macroscopically as well as microscopically on focused frozen sections. Based on these findings the decision for sphincter sparing reconstruction or amputation was taken.

**Results:** All patients underwent a neoadjuvant radio-/chemotherapy. The tumor was located 3.8cm from the anal verge measured by rigid rectoscopy preoperatively. In all cases the MRI revealed mrT3 tumors. One operation was performed with an open access, the remaining were performed laparoscopically or robotic. The intraoperative assessment showed a median distance of the lower boarder of the tumor to the resection margin of 10mm (2-15mm). In six patients sufficient distance of the tumor allowed a reconstruction while in two patients an abdominoperineal resection was needed. These patients had a distance of only 2 and 5 mm respectively. Initially the plan was to perform a reconstruction in seven patients and an abdominoperineal resection with permanent colostomy in one patient. In three patients (37.5%) the pathological assessment changed the operative strategy. In one patient the amputation could be omitted while two patients needed an amputation instead of the planned reconstruction. The final pathology showed R0 resection in all patients.

**Conclusion:** In patients with a low rectal cancer the decision to perform an amputation or reconstruction can be challenging preoperatively. The intraoperative assessment of the TME specimen by an expert pathologist together with the surgeon is a valuable tool to avoid unnecessary amputations or R1 resections in case of a reconstruction. We therefore suggest the routine intraoperative pathological assessment in cases of very low rectal cancer.

#### Short term outcome after appendectomy is not related to the time of day the procedure was performed – a nationwide analysis of 9'224 patients

C. Canal<sup>1</sup>, M. Lempert<sup>2</sup>, V. Neuhaus<sup>2</sup>, M. Turina<sup>3</sup>

<sup>1</sup>Department of Surgery, Hospital Oberengadin, Samedan, Switzerland, <sup>2</sup>Clinic for Traumatology, University Hospital Zurich, Zurich, Switzerland, <sup>3</sup>Department of Visceral and Transplant Surgery, University Hospital Zurich, Zurich, Switzerland

**Objective:** Acute appendicitis is one of the most common indications for abdominal surgery. The risk of perforation increases if the operation is delayed. Therefore, appendicitis is considered a surgical emergency leading to appendectomies being frequently performed off-hours. Numerous studies have shown less favorable outcomes for patients treated off-hours. The purpose of this study was to determine whether the time of day an appendectomy is performed has a significant impact on mortality and complication rate of patients.

**Methods:** We retrospectively analyzed all appendectomies recorded in a prospective national quality measurement database (AQC-database) between 2010 and 2017. Inclusion criteria were appendicitis (ICD-K35.00 to K37), patients must have been operated, and the time of day an appendectomy was performed had to be documented. We stratified the patients in four groups depending on the start of the operation. A total of 9'224 patients with a mean age of 36 +/- 19 years (54% males) were included and further analyzed. In-hospital mortality was the primary outcome, occurrence of any complications was the secondary outcome. Variables were sought in bi- and multivariate analyses. Time of surgery was entered in multiple regression analysis models for death and complications while controlling for confounders.

**Results:** Most appendectomies were performed during the afternoon and 13% in the night. The patients operated on at night had a slightly lower ASA-score, were assigned as an emergency in 98% of the cases, had fewer comorbidities and were more often publicly insured. The average duration of surgery was not significantly longer in the night group compared to the daytime groups. In-hospital mortality was 0.12% (n = 11), ranging from 0.082% (n = 1) in the "group night" and 0.17% (n = 5) in the "group evening". Day- or nighttime of the operation was not a predictor for mortality. The overall complication rate was 4.7%, ranging from 3.5% in the "group night" to 5.0% in the "group afternoon". However, the differences were not significant between the different groups.

**Conclusion:** There appears to be no significant effect of the time of day an appendectomy is performed regarding mortality and complications. Due to an increasing risk of perforation when waiting for elective operating slots, nighttime operations should be preferred considering the equal perioperative risk shown in this study.

### Simultaneous computer - assisted assessment of mucosal and serosal perfusion in a model of segmental colonic ischemia

B. Seeliger<sup>1</sup>, P. Mascagni<sup>1</sup>, F. Longo<sup>1</sup>, M. Barberio<sup>1</sup>, A. Lapergola<sup>1</sup>, D. Mutter<sup>1,2,3</sup>, A. Klymchenko<sup>4</sup>, V. Agnus<sup>2</sup>, J. Marescaux<sup>1,2</sup>, M. Diana<sup>1,2,3</sup>

<sup>1</sup>Institute of Image-Guided Surgery, IHU-Strasbourg, Strasbourg, France, <sup>2</sup>IRCAD, Institute for Research against Cancer of the Digestive System, Strasbourg, France, <sup>3</sup>Department of General, Digestive and Endocrine Surgery, Strasbourg University Hospitals, Strasbourg, France, <sup>4</sup>Nanobiochemistry and Bioimaging Lab, UMR 7021 CNRS, Faculty of Pharmacy, University of Strasbourg, Strasbourg, France

**Objective:** Adequate perfusion is crucial for optimal anastomotic healing. Fluorescence-based enhanced reality (FLER) is used to quantify fluorescence signal dynamics and to superimpose a virtual perfusion cartogram onto real-time laparoscopic images. In current surgical practice, fluorescence-guided perfusion estimation is obtained from the serosal side. The aim of this experimental study was to quantify potential differences (due to a different ischemia response) in mucosal and serosal perfusion levels in an ischemic colon segment.

**Methods:** An ischemic colon segment was created in 12 pigs. Simultaneous quantitative serosal and mucosal fluorescence imaging was obtained via intravenous indocyanine green injection (0.2mg/kg), using 2 near-infrared camera systems, and computer-assisted FLER analysis. Lactate levels were measured in capillary blood of the colonic wall at 7 regions of interest (ROIs) as determined by FLER analysis: the ischemic zone (I), the threshold of a 50% signal intensity variation over time proximally and distally at the mucosal and serosal side (P50M, P50S, D50M, D50S) and the proximal and distal vascularized areas (PV, DV).

**Results:** Perfusion level differences between mucosa and serosa were clearly identified using the perfusion cartographies. The mean ischemic zone as measured (mm) at the mucosal side was significantly larger than the serosal one ( $56.3 \pm 21.3$  vs.  $40.8 \pm 14.9$ ,  $p = 0.001$ ), with a mean difference of  $1.5 \pm 1.2$  cm. Mean lactate levels (mmol/L) in the ischemic area ( $3.8 \pm 2.1$ ), were significantly higher than those in P50M ( $2.2 \pm 2.7$ ,  $p = 0.0007$ ), P50S ( $2.6 \pm 2.6$ ,  $p = 0.01$ ), D50M ( $2.4 \pm 2$ ,  $p = 0.002$ ), D50S ( $2.8 \pm 1.9$ ,  $p = 0.003$ ), and vascularized zones (PV  $1.75 \pm 2.2$ ,  $p = 0.0001$ ; DV  $1.7 \pm 2.2$ ,  $p < 0.0001$ ). Due to the symmetrical distribution of ischemia, the pooled analysis of proximal ( $n = 24$ ) and distal ( $n = 24$ ) lactate levels showed significantly higher levels at the serosal side ( $2.7 \pm 2.2$  vs.  $2.3 \pm 2.3$ ,  $p = 0.02$ ).

**Conclusion:** In an experimental model of acute ischemia, the simultaneous image acquisition of both colonic wall sides showed larger ischemic mucosal zones as compared to serosal ones. The potential clinical relevance of these results calls for an assessment of perfusion from the mucosal side or for performing a larger resection when basing the analysis on serosal perfusion. Further studies are required to predict the optimal resection margin and anastomotic site in colonic resections.

### Tumor infiltration by OX40+ cells enhances the prognostic significance of CD16+ cell infiltration in colorectal cancer

F. Haak<sup>1</sup>, I. Obrecht<sup>1</sup>, N. Tosti<sup>2</sup>, B. Weixler<sup>1</sup>, R. Mechera<sup>1</sup>, S. Däster<sup>1</sup>, M. von Strauss<sup>1</sup>, T. Delko<sup>1</sup>, G. Spagnoli<sup>3</sup>, L. Terracciano<sup>2</sup>, G. Sconocchia<sup>4</sup>, M. von Flüe<sup>1</sup>, M. Kraljevic<sup>1</sup>, R. Droese<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Clarunis - University Abdominal Center, Basel, Switzerland, <sup>2</sup>Department of Pathology, University Hospital Basel, Basel, Switzerland, <sup>3</sup>Department of Biomedicine, University Hospital Basel, Basel, Switzerland, <sup>4</sup>Institute of Translational Pharmacology, National Research Council, Rome, Italy

**Objective:** Analysis of tumor immune-infiltration has been suggested to outperform TNM staging in predicting clinical course of colorectal cancer (CRC). Infiltration by cells expressing OX40, a member of the TNF receptor family, or CD16, expressed by natural killer cells, monocytes and dendritic cells, has been associated with favorable prognosis in patients with CRC. We hypothesized that assessment of CRC infiltration by both OX40+ and CD16+ cells might result in enhanced prognostic significance.

**Methods:** CRC infiltration by OX40 and CD16 expressing cells was investigated in 441 primary CRCs using tissue microarrays and specific antibodies, by immunohistochemistry. Patients' survival was evaluated by Kaplan-Meier and log-rank tests. Multivariate Cox regression analysis, hazard ratios and 95% confidence intervals were also used to evaluate prognostic significance of OX40+ and CD16+ cell infiltration.

**Results:** CRC infiltration by OX40+ and CD16+ cells was subclassified in 4 groups with high or low infiltration levels in all possible combinations. High levels of infiltration by both OX40+ and CD16+ cells were associated with lower pT stage, absence of PTL inflammation and a positive prognostic impact. Patients bearing tumors with high infiltration by CD16+ and OX40+ cells were also characterized by significantly longer overall survival, as compared with the other groups. These results were confirmed by analyzing an independent validation cohort.

**Conclusion:** Combined infiltration by OX40+ and CD16+ immune cells is an independent favorable prognostic marker in CRC. The prognostic value of CD16+ immune cell infiltration is significantly improved by the combined analysis with OX40+ cell infiltration.

## Thorax

### A novel combination strategy to treat KRAS-mutant lung cancer

R.-W. Peng<sup>1,2</sup>, S.-Q. Liang<sup>1</sup>, E. D. Bühner<sup>2</sup>, S. Berezowska<sup>3</sup>, T. M. Marti<sup>1</sup>, L. Froment<sup>1</sup>, H. Yang<sup>1</sup>, S. R. Hall<sup>1</sup>, E. Vassella<sup>3</sup>, Z. Yang<sup>1</sup>, G. J. Kocher<sup>1</sup>, M. J. Amrein<sup>2</sup>, C. Riether<sup>2</sup>, A. F. Ochsenbein<sup>2</sup>, R. A. Schmid<sup>1</sup>

<sup>1</sup>Division of General Thoracic Surgery, Inselspital, University Hospital of Bern, Bern, Switzerland, <sup>2</sup>Department for BioMedical Research (DBMR), University of Bern, Bern, Switzerland, <sup>3</sup>Institute of Pathology, University of Bern, Bern, Switzerland

**Objective:** Drug resistance inevitably limits clinical efficacy of cancer treatment, which is particularly relevant for KRAS-mutant cancers, the most common type of human malignancies defined by genetic alterations and the largest subset of tumors that cannot be effectively targeted by currently available therapeutics. The purpose of this study is to identify novel drug targets whose inhibition enhances the antitumor efficacy of standard first-line chemotherapy.

**Methods:** Various in vitro models that recapitulate KRAS-mutant lung cancer cells evolving acquired resistance to chemotherapy (cisplatin/pemetrexed) were generated and subjected to pharmacological screens. Tumor vulnerabilities selectively associated with drug-resistant cells were identified and characterized by in vitro, ex vivo and in vivo approaches.

**Results:** We found that the mammalian target of rapamycin (mTOR) pathway is hyperactivated in KRAS-mutant lung cancer cells that evolve resistance to chemotherapy and in patient-derived KRAS-mutant lung adenocarcinoma treated with chemotherapy. We further showed that drug-resistant KRAS-mutant lung cancer cells rely on persistent mTOR signaling for survival and that its inhibition restores sensitivity of resistant KRAS-mutant lung cancer cells to chemotherapy. Importantly, drug combinations of clinically approved mTOR inhibitors with chemotherapy synergize in inhibiting cell proliferation of KRAS-mutant cancer cells in vitro and in vivo. These results pinpoint activated mTOR signaling as a mechanism of resistance to chemotherapy in KRAS-mutant lung cancer and validate a rational and readily translatable strategy to treat KRAS-mutant lung cancer.

**Conclusion:** Our study identifies a novel mechanism of resistance mechanism to chemotherapy and validates a combination strategy to treat KRAS-mutant lung cancer.

### Chest wall resections and reconstructions for malignant diseases: a single center experience in 158 cases

L. Elahi-Rausis<sup>1</sup>, E. Abdelnour<sup>1</sup>, M. Gonzalez<sup>1</sup>, D. Hasselbach<sup>2</sup>, T. Krueger<sup>1</sup>, W. Raffoul<sup>2</sup>, H.-B. Ris<sup>1</sup>, J. Y. Perentes<sup>1</sup>

<sup>1</sup>Department of Thoracic Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>2</sup>Plastic and Reconstructive Surgery, Lausanne University Hospital, Lausanne, Switzerland

**Objective:** The surgical management of tumors involving the chest wall is challenging and should achieve complete resection and insure stability/function. Here we reviewed 158 chest wall resections performed in one center for diverse malignancies over a 15-year period and report in-hospital morbidity/mortality and oncological outcome.

**Methods:** The records of 158 chest wall reconstructions performed in 150 patients between 2003 and 2018 by a joint team of reconstructive and thoracic surgeons were reviewed. We determined, for each patient, the extent of resection, the reconstruction type, the postoperative surgical and non-surgical complications and the oncological long-term outcome.

**Results:** Chest wall resections were performed in the context of lung cancer (31%), primary chest wall tumors (33%), breast cancer (15%) or metastasis (20%). Full thickness (skin, muscle, ribs ± sternum ± clavicle) chest wall resection was performed in 66 cases while the other 92 cases involved bony chest wall with no superficial soft tissue. Associated lung resections were required in 72 patients (wedge 43%, lobectomy 43%, pneumonectomy 14%). Chest wall reconstructions were performed using pedicled muscle flaps (15%) prosthetic chest wall substitutes (mesh with and without methyl methacrylate reinforcement, 38%) or a combination of both (47%). The postoperative mortality was of 2.5% and related to septic/hemorrhagic shock (n=3) and pulmonary embolism (n=1). Postoperative morbidity consisted of pneumonia (21%), arrhythmia (10%), pleural effusion (15%) and pulmonary embolism (2%). A complete tumor resection was obtained in 123 patients (78%) and chest wall stability and integrity was achieved in all patients. Mean patient follow-up was of 44 ± 43 months Overall and disease free survival were 46 ± 44 and 31 ± 41 months, respectively.

**Conclusion:** Chest wall resections and reconstructions performed in the context of a multimodal approach can offer rewarding overall and disease free survivals while preserving the chest wall integrity and functionality. Postoperative morbidity and mortality rates are acceptable.

#### Comparison of intrapleural use of urokinase and t-PA/DNase in pleural infection

B. Bédar<sup>1</sup>, J. Plojoux<sup>2</sup>, J. Noel<sup>1</sup>, A. Morel<sup>1</sup>, J. Worsley<sup>1</sup>, F. Triponez<sup>1</sup>, W. Karenovics<sup>1</sup>

<sup>1</sup>Department of Thoracic and Endocrine Surgery, Geneva University Hospitals, Geneva, Switzerland, <sup>2</sup>Division of Pneumology, Geneva University Hospitals, Switzerland

**Objective:** Fibrinolysis can be used to improve fluid drainage in pleural infection. Treatment with either urokinase or tissue plasminogen activator (t-PA) in association with deoxyribonuclease (DNase) via a chest tube has been effective at reducing the need for surgery. This study is the first to compare the efficacy of these two treatments.

**Methods:** We performed a single-centre controlled prospective cohort study. All individuals with pleural infection admitted to our hospital between January 2014 and December 2017, who were treated with antibiotics, a chest tube, and fibrinolysis, were included in this study. The rate of additional procedure requirements (additional chest tube or surgery) after initial fibrinolysis, complications, costs, and radiological and biological outcomes were analysed.

**Results:** Among the 93 patients included in this study, 34% experienced additional procedure after an initial fibrinolysis, including 21% who received an additional chest tube and 13% who underwent thoracoscopy. The need for additional procedure arose due to presence of multiple pleural collections (P=0.01) and was associated with the use of large-bore drain (P=0.01). The success rate of fibrinolysis was not significantly different between urokinase and t-PA/DNase (P=0.35). The difference in drainage duration and in length of hospital stay were not significant as well (P=0.05 and P=0.12, respectively). Treatment with t-PA/DNase was cheaper (P=0.04) but was also associated with a higher rate of haemothorax (P=0.002).

**Conclusion:** In conclusion, treatment with urokinase is safer and equally effective when compared with treatment with t-PA/DNase.

#### Low dose photodynamic therapy promotes a cytotoxic immunological response in a murine model of malignant pleural mesothelioma

S. Cavin<sup>1</sup>, J. Faget<sup>2</sup>, A. Gkasti<sup>2</sup>, Y. Hao<sup>1</sup>, E. Meylan<sup>2</sup>, J. Y. Perentes<sup>1</sup>

<sup>1</sup>Department of Thoracic Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>2</sup>SV-ISREC, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

**Objective:** Malignant pleural mesothelioma (MPM) is an aggressive neoplasm with limited treatment options. An increased 5-year survival rate was reported

in patients with MPM managed by multimodal therapy including extended pleural decortication and photodynamic therapy (PDT). Recent data has suggested that durable disease control in MPM patients was associated to patient immunization against their cancer. Here we determined the immunological impact of low dose Visudyne (BPD-MA)-mediated PDT (L-PDT) in a syngeneic immunocompetent murine model of MPM.

**Methods:** MPM AE17 cells were implanted in C57BL/6 mice (n=24) and grown up to 30mm<sup>3</sup> in volume. Animals were then separated into two treatment groups: L-PDT (BPD-MA 0.4 mg/kg i.v., 10J/cm<sup>2</sup>, 50 mW/cm<sup>2</sup>, drug-light interval 10 min, n=12) and control (BPD-MA 0.4 mg/kg i.v., no light exposure, n=12). Half of each treatment group was sacrificed at day 2 while the other half at day 7. Tumors were harvested and processed for analysis by 16-color flow cytometry to extract the tumor immune signature and determine its response to treatment.

**Results:** We observed no difference in tumor size in this study between treatment groups. Multi-color flow cytometry analysis revealed a significant increase in the proportion of CD8+ T cells (CD8+CD3+, p<0.05) as well as an enhanced activation of macrophages (p<0.05), CD11b+ dendritic cells (p<0.05) and of myeloid derived suppressor cells (mMDSs, p<0.05) two days after L-PDT compared to controls. Interestingly, seven days after L-PDT, while CD8+ T cells remained high (p<0.05), the proportion of macrophages and of CD4+CD103+ cells went down (p<0.05). In parallel, the activation status of CD11b+ dendritic cells and mMDS were decreased (p<0.05) while the activation status of macrophages was increased (p<0.05).

**Conclusion:** L-PDT created a marked modification of the immune signature of MPM that seem to favor a CD8+ cytotoxic T cell response. Further work combining this approach with immune checkpoint inhibition may help boost the impact of immunotherapy, particularly in tumors with low immunogenicity such as MPM.

#### Outcomes of patients discharged home with a chest tube following Anatomical Lung Resection: a multicenter Cohort Study

F. Minervini<sup>1</sup>, W. C. Hanna<sup>2</sup>, A. Brunelli<sup>3</sup>, F. Farrokhyar<sup>4</sup>, T. Miyazaki<sup>3</sup>, L. Bertolaccini<sup>5</sup>, M. Scarci<sup>6</sup>, M. Coret<sup>2</sup>, K. Hughes<sup>2</sup>, L. Schneider<sup>2</sup>, Y. Lopez-Hernandez<sup>2</sup>, J. Agzarian<sup>2</sup>, C. Finley<sup>2</sup>, Y. Shargall<sup>2</sup>

<sup>1</sup>Department of Thoracic Surgery, Cantonal Hospital of Lucerne, Lucerne, Switzerland, <sup>2</sup>Department of Thoracic Surgery, McMaster University, Hamilton, Canada, <sup>3</sup>Department of Thoracic Surgery, St. James University Hospital, Leeds, United Kingdom, <sup>4</sup>Department of Surgery, McMaster University, Hamilton, Canada, <sup>5</sup>Department of Thoracic Surgery, Maggiore Teaching Hospital, Bologna, Italy, <sup>6</sup>Department of Thoracic Surgery, San Gerardo Hospital, Monza, Italy

**Objective:** Prolonged air leak following lung resections remains a common postoperative complication. With more minimally invasive resections and earlier hospital discharges, more patients are expected to be discharged home with a chest tube. We evaluated the outcomes of those patients and potential risk factors associated with adverse outcomes.

**Methods:** Retrospective analysis of prospectively collected data from four tertiary academic centers between 1.2014 and 12.2017. Missing post-discharge data were completed via phone call to patients and their family physicians. Data was analyzed for 253 patients, representing 9.0% of all patients undergoing anatomical lung resections during that period. Chi-square and Mann-Whitney U tests were used to assess for patients and operative parameters associated with outcomes post discharge. Logistic regression was performed to evaluate factors associated with risk of empyema development and need for readmissions and intervention.

**Results:** Of 253 patients analyzed, there were 67/857 patients from center A (7.8%), 30/759 from center B (3.95%), 147/931 from center C (15.78%), and 9/247 from center D (3.64%) (p<0.001). Median age was 69 (19-88), 56% males. Overall, 49 patients (19.4%) were readmitted (21%, 0%, 23%, 11%, centers A-D, respectively, p=0.029) and analyzed. Of those, 18 (37%) developed empyema, 11 (22%) required surgery and 3 (6%) died. Median LOS was 8 (3-63) and 7 (3-30) days for readmitted vs not-readmitted patients (p=0.588). Comorbidities (p=0.1-0.9), approach (MIS vs thoracotomy, p=0.75) and extent of resection (p=0.577) were not associated with risk of readmissions. Median overall initial duration of chest tube was 22 days (4-141) for readmitted patients vs 16 (1-148) days for not readmitted (p<0.001). Duration of chest tube stay was the only factor associated with development of empyema (p=0.003). The

risk of empyema increased 3-fold (OR = 2.94) when chest tube was left in-situ for more than 20 days.

**Conclusion:** Home discharge with a chest tube following lung resection is associated with significant adverse events. Given high risk of empyema development, removal of chest tube should be considered, when appropriate, after 20 days. Our data suggests potential need for active post-discharge outpatients program, in order to diminish subsequent risk of morbidity and mortality.

#### Pattern of release of damage associated molecular patterns after experimental ex - vivo lung perfusion and lung transplantation

A. Hasenauer<sup>1</sup>, E. Abdelnour-Berchtold<sup>1</sup>, B. Bédard<sup>2</sup>, R. Parapanov<sup>1</sup>, A. Debonneville<sup>1</sup>, M. Gonzalez<sup>1</sup>, J.-Y. Perentes<sup>1</sup>, H.-B. Ris<sup>1</sup>, J. Lugin<sup>1</sup>, L. Liaudet<sup>3</sup>, T. Krueger<sup>1</sup>

<sup>1</sup>Division of Thoracic Surgery, Lausanne University Hospital, Lausanne, Switzerland,

<sup>2</sup>Division of Thoracic Surgery, Geneva University Hospitals, Geneva, Switzerland,

<sup>3</sup>Service of Adult Intensive Care Medicine, Lausanne University Hospital, Lausanne, Switzerland

**Objective:** The release of damage associated molecular patterns (DAMPs) by injured cells during reperfusion may trigger innate immune responses after lung transplantation (LTx). The pattern of DAMPs release following LTx, and the possible influence of ex vivo lung perfusion (EVLP), is largely undefined. We evaluated the release of 4 major DAMPs by lung grafts during EVLP and after LTx in a rat model. We also sought to compare the release of DAMPs by lungs grafts obtained after either cold or warm ischemia.

**Methods:** 4 groups of donor lungs were investigated: (1) Cold ischemia (CI): lungs stored at 4°C for 7 h; (2) Warm ischemia (WI): Lungs kept at room temperature (RT) for 1h, then 6h at 4°C; (3) Cold ischemia plus EVLP (CIE): Lungs stored at 4°C for 2 h, followed by EVLP for 3 h and additional storage at 4°C for 2h. (4) Warm ischemia plus EVLP (WIE): Lungs kept at RT for 1h, followed by 1h at 4°C and then EVLP as above. At the end of storage and EVLP, the right lung was used for bronchoalveolar lavage (BAL) and the left lung for Ltx, with its BAL collected after 2 h reperfusion. The Steen<sup>®</sup> solution used for EVLP was also collected. The DAMPs HMGB1, S100A8, IL-33 and HSP-70 were determined by ELISAs in the BAL and Steen<sup>®</sup>.

**Results:** At the end of preservation and EVLP, high levels of HMGB1, IL-33, S100A8 and Hsp70 were recovered in the BAL of all 4 groups with no significant differences, except from Hsp70, significantly reduced in WIE group. In Steen<sup>®</sup> solution, very high DAMPs levels were recovered in similar concentrations in CIE and WIE. After LTx, lungs exposed to WI tended to display increased levels of HMGB1 and IL-33, and had significantly lower levels of Hsp70, irrespective of EVLP.

**Conclusion:** Major DAMPs are released by lung allografts both after CI or WI, with minor influence of EVLP. Hsp70 is reduced after WI, irrespective from EVLP. These findings open new perspective for the understanding of innate immune activation following EVLP and LTx.

#### Stage IIIA should be divided in two different subgroups according to n and t stage in patients with resected lung cancer: validation with another center database

N. Citak<sup>1,2</sup>, L. Guglielmetti<sup>1</sup>, Y. Aksoy<sup>3</sup>, O. Isgörücü<sup>2</sup>, M. Metin<sup>3</sup>, A. Sayar<sup>2</sup>, I. Opitz<sup>1</sup>, D. Schneider<sup>1</sup>, W. Weder<sup>1</sup>, I. Inci<sup>1</sup>

<sup>1</sup>Department of Thoracic Surgery, University Hospital Zurich, Zurich, Switzerland,

<sup>2</sup>Department of Thoracic Surgery, Bakirkoy Dr. Sadi Konuk Research and Education Hospital, Istanbul, Turkey, <sup>3</sup>Department of Thoracic Surgery, Yedikule Thoracic Surgery and Chest Disease Research and Education Hospital, Istanbul, Turkey

**Objective:** Stage IIIA-NSCLC includes a very heterogeneous group of patients depending on tumor localization, and extension of nodal disease. Therefore therapy still remains very controversial. The purpose of our study was to compare the survival between Stage IIIA subsets (T3N1 or T4N0/1 versus T1/2N2), and to validate our results with another center database.

**Methods:** Between 2007 and 2017, 2057 patients completely resected for NSCLC were retrospectively analyzed. There were 424 patients who had Stage IIIA and 82 patients who had Stage IIIB (T3/4N2). Stage IIIA patients were divided into two subsets according to tumor localization (T3N1

and T4N0/1, IIIA-T group; n = 308) and extension of nodal disease (T1/2N2, IIIA-N2 group; n = 116). Age, gender, pack/years, and comorbidity did not differ between subsets. Another Thoracic Surgery Center cancer database was used for validation.

**Results:** IIIA-N2 group had more adenocarcinoma than IIIA-T group (52.6% vs 29.5%, p < 0.001), and pneumonectomy was more performed in IIIA-T group (51.0% vs 32.8%, p = 0.001). In multivariate analysis, N2 and age > 65 were significant independent negative prognostic factors (p < 0.001). Five-year survival for patients in IIIA-T group was 51.3% (median 64 months), whereas it was 25.7% (median 31 months) for IIIA-N2 patients (HR: 1.834, 95%CI [1.345-2.501], p < 0.0001) (Figure 1). There was no statistically difference regarding the survival between IIIA-N2 and Stage IIIB (25.7% vs 25.3%, p = 0.4). According to the results, we performed a re-staging for Validation Cohort patients as; Stage IIIA-T (including T3N1 and T4N0/1) (n = 139), Stage IIIA-N (including T1/2N2) (n = 104), and Stage IIIB (n = 50). Stage IIIA-T had a statistically better survival than Stage IIIA-N (50.5% vs 27.1%, HR: 1.707, 95%CI [1.231-2.366], p = 0.0007), whereas five-year survival rates were similar for Stage IIIA-N and Stage IIIB (27.1% vs 27.1%, p = 0.9) (Figure 2).

**Conclusion:** Since our results were validated with another center database, we propose that stage IIIA should be divided into two different subgroups according to the primary tumor extension (T) and mediastinal lymph node involvement (N) in the next TNM classification.

#### The impact of patient compliance and individual components in an ERAS pathway on the outcome of anatomical VATS resections

C. Forster<sup>1</sup>, V. Doucet<sup>1</sup>, J.-Y. Perentes<sup>1</sup>, E. Abdelnour-Berchtold<sup>1</sup>, T. Krueger<sup>1</sup>, L. Rosner<sup>2</sup>, M. Gonzalez<sup>1</sup>

<sup>1</sup>Department of Thoracic Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>2</sup>Department of Anesthesiology, Lausanne University Hospital, Lausanne, Switzerland

**Objective:** Implementation of an enhanced recovery after surgery (ERAS) pathway has shown to improve post-operative outcome. However, the impact of compliance (overall and to specific elements of the program) has been rarely reported in thoracic surgery and was the subject of this study.

**Methods:** We included all consecutive patients undergoing video-assisted thoracoscopy (VATS) anatomical pulmonary resection after the implementation of an ERAS pathway. Demographics, surgical characteristics and peri- and post-operative adherence to 16 elements of the ERAS program were assessed. Post-operative outcomes and length of stay were compared between low (<75% of adherence) and high compliance (>75%) groups. Logistic regression was undertaken to identify individual elements related to post-operative complications and a length of stay of >4 days (delayed discharge).

**Results:** A total of 192 ERAS patients, 98 women and 94 men, with a median age of 66 years (range 28-87), underwent VATS anatomic lung resection (109 lobectomies, 84 segmentectomies). There was no 30-day mortality and the re-operation rate was 6.3%. The overall compliance to ERAS protocol was 76%. Overall and pulmonary postoperative complications were observed in 33% and 28%, respectively. The median postoperative length of hospitalization was 4 days (range 1-100). The high-compliance group was correlated with fewer complications (OR: 0.25, p < 0.0001) and lower rate of delayed discharge (OR: 0.39, p = 0.0013). Early removal of chest tubes (OR: 0.26, p < 0.002), use of electronic drainage (OR: 0.39, p = 0.036), cessation of opioid administration on day 3 (OR: 0.28, p = 0.016) and early feeding (OR: 0.12, p = 0.014) were all associated with reduced postoperative complications. Shorter hospital stay was correlated with early removal of chest tubes (OR: 0.12, p < 0.0001) and cessation of opioid administration on day 3 (OR: 0.23, p = 0.001).

**Conclusion:** High compliance to ERAS program (overall and to some individual elements) seems to improve the post-operative outcome in patients undergoing anatomical pulmonary VATS resections.

## Traumatology

### Are routine radiographs needed the day after open reduction and internal fixation surgery for distal radius and ankle fractures: a prospective, open label, randomized controlled trial

V. Kremö, F. Oehme, B. Link, M. Stickel, J. Mühlhäusser, J. Brunner, R. Babst, F. Beeres

*Department of Surgery, Cantonal Hospital of Lucerne, Lucerne, Switzerland*

**Objective:** Distal radius and ankle fractures are one of the most common operatively treated fractures. To date, there is no consensus concerning the need for a standard postoperative radiograph. This leads to undesirable practice variations. If standardized intraoperative radiographs have been obtained, it is questionable if these postoperative radiographs are necessary and will lead to changes in the treatment strategy. If standard postoperative radiographs are no longer required, this would lead to a reduction in radiation exposure and health care costs. The hypothesis is that routine standardized postoperative radiographs do not influence the quality of care for patients operated on for either a distal radius or an ankle fracture if adequate intraoperative standardized radiographs have been obtained.

The primary aim of this study is to evaluate if there is a need for routine postoperative radiographs after an osteosynthesis of a distal radius or ankle fracture.

**Methods:** In a prospective, randomized controlled, open label trial based on a non-inferiority design, we enrolled 332 patients. The control group was treated according to our current, standard protocol in which all patients received a standard anterior-posterior and lateral radiograph on the first postoperative day. Patients randomized to the intervention group were treated without a standard postoperative radiograph. All patients (n = 332) had a routine clinical and radiographic control after 6 weeks in the outpatient clinic. Primary outcome is a change in treatment plan, defined as either additional imaging or a reoperation based on the intraoperative or postoperative imaging.

**Results:** The trial started in August 2016 and ended in September 2018. 445 patients were screened, 332 were included. In the control group 4 out of 155 (2.6%) had an additional imaging or a reoperation, in the intervention group 8 out of 164 (4.9%) had a change in treatment plan. Statistically there is a non inferiority of the intraoperative radiographs compared to the additional postoperative radiographs.

**Conclusion:** Our findings prove that there is no need for postoperative radiographs if the intraoperative radiographs are adequate. This may lead to a strong reduction in radiation exposure and health care costs. A preliminary, conservative estimation suggests a yearly cost saving of CHF 1.3 million in Switzerland.

### Conventional fluoroscopy-guided percutaneous placement of iliosacral screws in the era of intraoperative 3D imaging and navigation: inappropriate or still a valid option?

H. Kuttner, E. Benninger, C. Meier

*Department of Orthopedics and Traumatology, Cantonal Hospital Winterthur, Winterthur, Switzerland*

**Objective:** The percutaneous placement of iliosacral screws (ISS) is an established technique for the fixation of posterior pelvic ring injuries. The anatomy of the sacrum is complex and the landmarks may be difficult to identify with conventional fluoroscopy, particular in osteoporotic bone or in the presence of interfering bowel gas. Malpositioning of ISS is a complication with potential injury to adjacent neurovascular structures. Thus, computer navigated screw insertion has gained increasing popularity. It was the aim of this study to evaluate the quality of conventional fluoroscopy-guided percutaneous placement of ISS.

**Methods:** In 2017, the surgical procedure was standardized following a step by step technique using conventional intraoperative fluoroscopy. All procedures between 01/2017 and 12/2018 were included. All patients underwent computed tomography (CT) for fracture analysis and preoperative planning. Surgery was performed percutaneously in supine position. Following the standardized procedure, a postoperative CT was performed to confirm proper screw position. The screw position was defined to be either correct or with tangential involvement or true hit of the neuroforamina or spinal canal, or with anterior or superior bone

perforation. Postoperative complications and revision surgeries were recorded as well.

**Results:** Median age was 78 years (range 16-91 years). In total, 50 ISS were inserted in 26 patients, 32 ISS into S1 and 18 into S2, respectively. In a 16 year old patient, 2x6.5 cannulated screws were used, all other patients received 7.3 cannulated screws. Regarding S1, malposition was observed for 2 ISS (6%), of these, 1 (3%) with tangential involvement of the spinal canal and 1 (3%) anterior bone penetration. For S2, tangential involvement of the spinal canal was seen for 3 (17%) ISS. Screw malposition did not cause any neurovascular complications. Early migration resulted in screw exchange in 1 case (2%) and another 2 ISS had to be removed prematurely due to symptomatic loosening (4%).

**Conclusion:** Following a standardized step by step surgical technique, conventional ISS placement is reliable and safe. Due to the smaller dimensions, ISS malposition was more frequently observed in S2 than in S1. However, only tangential involvement of the spinal canal occurred and no neurovascular complications were seen.

### Elbow hemiarthroplasty for selected distal humerus fractures in the elderly: a preliminary report

D. Rikli<sup>1</sup>, M. Schmelz<sup>2</sup>, A. M. Müller<sup>1</sup>, C. Schwaller<sup>2</sup>, S. Müller<sup>1</sup>, M. Jakob<sup>1</sup>

*<sup>1</sup>Department of Orthopedics and Traumatology, University Hospital Basel, Basel, Switzerland, <sup>2</sup>Department of Orthopedics and Traumatology, Cantonal Hospital Olten, Olten, Switzerland*

**Objective:** Primary Total Elbow Arthroplasty (TEA) is an option in the treatment of acute distal humerus fractures in the elderly. Results comparable to ORIF have been reported. However, loading of the upper extremity after TEA must be restricted which may limit activities of patients who use their upper limb as a walking aid. Hemiarthroplasty is an alternative in the fracture situation where the proximal forearm is not involved. If the elbow is stable (healed epicondyles), the extremity can be used without limitations.

**Methods:** Between 4/2017 and 7/2018 we have used Elbow Hemiarthroplasty (Latitude, Fa. Wright/Tornier) as a primary treatment in 6 consecutive elderly female patients (70-88y) with extremely low distal humerus fractures that seemed not to be amenable to ORIF. Routine radiological follow up was performed at 6 and 12 weeks and at latest follow up. Clinical outcome was documented with ROM, pain VAS, a Subjective Elbow Value (SEV), Quick-DASH, Oxford Elbow Score, and Mayo Elbow Performance Score. Suhm's scale was used to assess any change in self-dependency.

**Results:** There were no implant related complications or infections. All epicondyles healed with a stable elbow except one with a slight medial opening that was asymptomatic. One patient who had a delayed initial operation (2 weeks post trauma) needed a revision operation (arthrolysis and removal of periarticular ossifications) 6 months after the index procedure due to stiffness. The remaining had a subjectively satisfactory result (SEV 80-100%), ROM > 100° and good to excellent clinical scores ratings. 4/6 used a walking aid (Rollator), all returned to their premorbid social environment.

**Conclusion:** Elbow Hemiarthroplasty appears to be a valuable option in the treatment of difficult distal humerus fractures in the elderly. Compared to Total Elbow Arthroplasty restrictions in loading the extremity are not necessary which is an advantage for patients who use their upper limb for walking aids. Long term results are needed.

### Medical scribes as a key help on the emergency department: an action to reduce the administrative burden for assistant physicians

M. Dosch, T. Hertig, J. Sinistra, D. Inderbitzin, A. Ringger

*Department of General Surgery, Bürgerspital Solothurn, Solothurn, Switzerland*

**Objective:** Electronic health recording (EHR) has created an abundance of administrative activities that keep doctors away from their patients and holds them in front of their computer. Less time with patient decreases patient and physician satisfaction and increases risks for inappropriate prescription and malpractice. Our project aims to observe the impact of medical scribes on the administrative burden for assistant physicians on the emergency department. We

hypothesize that patient and physician satisfaction will increase when physician have more time available for direct patient contact.

**Methods:** A scribe program was implemented on the emergency department during labour-intensive periods, that are typically outside office hours and therefore difficult to cover by secretaries. We performed a quasi-experimental prospective cohort study, measuring time used for documentation as a primary endpoint. Physician productivity in terms of time, and patients / physician satisfaction, quantified using Likert-Type scales, were used as secondary endpoints. A total of 10 physicians and 2 medical scribes took part in the study. Scribes were trained for 1 month before data recording.

**Results:** In our data so far, we observed a significant reduction of the time passed in front of the computer for documentation, including reports writing, from  $55.3\% \pm 2.6\%$  without a medical scribe to  $33.2\% \pm 4.8\%$  with a medical scribe ( $p=0.0145$ , Mann-Whitney test). Time passed with the patient was increased from  $18.5\% \pm 2.2\%$  to  $46.2\% \pm 3.2\%$  ( $p=0.0012$ , Mann Whitney test). We observed no difference in the time used for patient care that were  $13.87\% \pm 5\%$  and  $11.52\% \pm 2.9\%$  ( $p=0.6838$ , Mann Whitney test). Results from questionnaires are still in progress. The number of patients seen by the doctors was not controlled.

**Conclusion:** Our preliminary data indicate that medical scribes reduce the administrative burden for the assistant physician in the emergency department and increase valuable time with the patient. We expect that this will have a positive impact on patient and physician satisfaction too.

315 → zurückgezogen, da inzwischen in einem anderen Magazin publiziert

#### Simple correction technique of femoral malrotation after PFN - A osteosynthesis of trochanteric fracture

K. Pavotbawan, P. Stillhard, C. Sommer

Department of Surgery, Trauma Surgery Unit, Cantonal Hospital Graubünden, Chur, Switzerland

**Objective:** Malrotation after intramedullary nailing in femoral shaft fractures are well known. But malrotation after nailing of trochanteric fractures is, in our view, an underestimated problem. During surgery the axial alignment can easily be evaluated by fluoroscopy in both planes. But the torsional alignment is difficult to assess especially with the patient placed on the traction table. In the literature a malrotation after PFNA is described in up to 25% of the cases. A revision with replacement of the blade, especially in patients with poor bone quality, may result in a reduced stability. To our knowledge there is no publication till to date to give a treatment pathway for this problem. We developed a rather easy technique to derotate a malrotated femur after PFNA fixation.

**Methods:** The basic idea of our technique is to leave the usually well placed blade in situ in the femoral head, just rotating the distal main fragment around the nail. To be able to do this, a small U-shaped osteotomy with a chisel is performed in the femoral cortex just anterior of the entry site of the blade. The length (l) of this osteotomy can be calculated, following the formula:  $l = d \times \pi \times \alpha / 360$  ( $d$  = diameter of femur,  $\alpha$  = angle of malrotation). Then the distal locking bolt is removed, the leg derotated externally and finally locked again. The procedure is controlled by two Schanzscrews separately inserted in both main fragments angulated to each other in the angle "α".

**Results:** Since 2014 three patients were detected with a clinically relevant malrotation after PFNA for trochanteric fracture. All patients had an internal malrotation from 30 to 40 degrees confirmed and measured by CT scan. All of them were successfully revised in the above described technique 5 to 9 days after initial fixation. The postoperative course was in all patients without complication.

**Conclusion:** First, we believe that malrotation after trochanteric fracture fixation is an underestimated problem. And second our method is a simple salvage procedure for malrotated trochanteric fractures after PFNA, leaving the blade in situ in the femoral head.

#### Standard abdominal follow-up imaging has no advantage in the non-operative management of blunt splenic injury in adult patients

R. Liechti<sup>1</sup>, M. Sticke<sup>2</sup>, L. Fourie<sup>3</sup>, B.-C. Link<sup>1</sup>, J. Metzger<sup>3</sup>, R. Babst<sup>1</sup>, F. Beerers<sup>1</sup>

<sup>1</sup>Department of Orthopedics and Traumatology, Cantonal Hospital of Lucerne, Lucerne, Switzerland, <sup>2</sup>Interdisciplinary Emergency Center, Cantonal Hospital of Lucerne, Lucerne, Switzerland, <sup>3</sup>Department of General and Visceral Surgery, Cantonal Hospital of Lucerne, Lucerne, Switzerland

**Objective:** To date, limited evidence exists regarding follow-up imaging during the non-operative management (NOM) of blunt splenic injury (BSI). The aim of this study was to investigate the incidence and time to failure of NOM as well as to evaluate the relevance of follow-up imaging.

**Methods:** All adult patients with BSI admitted to our level I trauma center, including two associated hospitals, between 01/01/2010 and 31/12/2017 were retrospectively analyzed. We reviewed demographic data, comorbidities, injury pattern, trauma mechanism, Injury Severity Score, splenic injury grade and free intra-abdominal fluid. Additional analysis of indication, frequency, modality, results and consequences of follow-up imaging was performed. Risk factors for failure of NOM were evaluated using fisher's exact test. Potential differences of quantitative variables were evaluated using the Wilcoxon rank-sum test.

**Results:** A total of 122 patients met inclusion criteria; 29 female (23.8%) and 93 male (76.2%), with a mean age of  $43.8 \pm 20.7$  years (16-84 years). 20 patients (16.4%) underwent immediate intervention; 10 (8.2%) splenectomies, 4 (3.3%) spleen conserving surgeries, 6 (4.9%) angio-embolizations. 102 patients (83.6%) were treated by NOM. Failure of NOM occurred in 4 patients (3.9%). Failure was significantly associated with active bleeding (3 of 4 [75%] failures vs. 8 of 98 [8.2%] non-failures, OR 33.75, 95% CI 3.1, 363.2,  $p=0.004$ ), and liver cirrhosis (2 of 4 [50%] failures vs. 0 of 98 [0%] non-failures, OR 197, 95% CI 7.4, 5265.1,  $p=0.001$ ). 81 patients (79.4%) in the NOM-Group received follow-up imaging by ultrasound (US) or computed tomography (CT). In 58 cases, standard imaging examinations were conducted (43 US and 15 CT scans) without prior clinical deterioration. 56 (96.6%) of these imaging results revealed no new significant findings. None of the patients receiving standard imaging developed failure of NOM. Every failure was detected by CT scans which were conducted due to clinical deterioration during the first 48 hours. The 4 CT scans were performed significantly earlier than the other follow-up imaging examinations ( $p=0.011$ ).

**Conclusion:** The present study indicates that a standard follow-up imaging in the NOM of BSI in adult patients has no therapeutic advantage. Follow-up imaging should be based on clinical findings and include either contrast enhanced CT or US.

#### Testing the (M)GAP in a Swiss trauma centre: an emergency score useful to forecast mortality, but limited in predicting the need for essential centre resources

P. Braken<sup>1</sup>, M. Zeindler<sup>1</sup>, F. Amsler<sup>2</sup>, T. Gross<sup>1</sup>

<sup>1</sup>Department of Traumatology, Cantonal Hospital Aarau, Aarau, Switzerland, <sup>2</sup>Amsler Consulting, Amsler Consulting, Basel, Switzerland

**Objective:** By using the modified emergency room (ER) trauma team activation (TTA) criteria of the TraumaNetwork DGU® we demonstrated possible over- and undertriage rates as recommended by the American College of Surgeons. Since non-adherence to the extensive triage criteria list was a major reason for observed undertriage, we tested the precision of two more simple pre-clinical triage tools (M)GAP ((Mechanism), Glasgow Coma Scale (GCS), Age and Systolic Blood Pressure) for resulting over- and undertriage with regard to several outcome parameters.

**Methods:** Retrospective analysis of consecutively registered adult ER trauma patients, treated in a Swiss trauma centre from 2013-2017. All cases were analysed regarding subsequent over- and undertriage when using the (M)GAP in comparison to proposed TraumaNetwork ERTTA criteria as to identify patients with an Injury Severity Score (ISS) > 15, need for trauma centre resources and hospital mortality.

**Results:** 2130 injured received ER treatment. A calculation of the (M)GAP was possible in 2112 cases. 24% had an ISS > 15, 34% were treated in the intensive care unit (ICU), 21% needed intubation, 13% underwent emergency surgery and 181 patients (8.5%) died in the hospital. Regarding mortality,

the use of (M)GAP would have missed one patient (undertriage 0.6%), whereas 766/2112 patients (overtriage 42%) would be unnecessarily treated in the ER. With respect to the ER selection criterion ISS > 15 or need of trauma centre resources (ICU, emergency surgery, intubation) the (M)GAP showed over- and undertriage rates ranging between 32–39% and 18–32%, respectively. In comparison, the proposed ERTAA criteria predicted mortality with an under- and overtriage of 1.7% and 69%. For the ER selection criterion ISS > 15 or need of trauma centre resources under- and overtriage ranged between 2–9% and 61–65%, respectively.

**Conclusion:** This Swiss trauma centre investigation confirmed the precision of the (M)GAP tools in the prediction of hospital mortality for ER trauma patients. Even though, in the preclinical decision process for trauma centre need, their clinical benefit demonstrated to be inferior to proposed ERTAA criteria, due to unacceptably high undertriage rates for patients with potential severe injury and need for subsequent therapy. Therefore, more extensive ERTAA cannot be substituted by simpler scores such as the (M)GAP.

#### The cortical overlap view – a tool for reproducible determination of the entry point for proximal femoral nailing

K. Boernert<sup>1</sup>, F. J. Beeres<sup>1</sup>, C. Jiamton<sup>2</sup>, R. Babst<sup>1</sup>, B. C. Link<sup>1</sup>

<sup>1</sup>Department of Orthopedics and Traumatology, Cantonal Hospital of Lucerne, Lucerne, Switzerland, <sup>2</sup>Department of Orthopaedics, Lerdsin Hospital, Bangkok, Thailand

**Objective:** Implant-related complications after proximal femoral nailing of trochanteric fractures occur in 6 to 21%. Besides appropriate reduction of the fracture, it is crucial to identify the correct entry point for the implant. Accurate intraoperative choice of the entry point is dependent on identification of the tip of the greater trochanter (GT) and requires proper radio-anatomic understanding of the proximal femur. A radiological view was defined to provide readily identifiable radio-anatomic landmarks which allows sound determination of the tip of the GT in the anteroposterior (ap) view. The aim of this study is to characterise this radiological view and test its intra- and inter-observer reproducibility.

**Methods:** Anatomical and radio-anatomical features of 16 cadaveric femurs were analysed. A radiological view was identified that is characterised by the radiological overlap of the density line of the piriformis fossa and the posterior-superior boarder of the GT. It marks the rotation of the proximal femur in which the GT can be accurately identified and safely used to determine the proper entry point for a proximal femoral nail. This view was called cortical overlap view (COV). Five junior and 5 senior orthopaedic trauma surgeons were asked to identify the correct COV in radiological imaging series at the beginning of the study and 4 weeks after. Intra- and interrater reliability was calculated using the intraclass correlation coefficient.

**Results:** Mean internal rotation of the femur to achieve a correct COV was 17.5° (range 12.8°–21.8°). The mean distance from the cortical overlap line in the correct COV to the tip of the GT was 4.5 mm (range 4.1–4.8mm, CI 95%). Intra-rater and interrater reliability was high with ICC(2,k)=0,932 (95%CI: 0,826 – 0,985) and ICC(2,k)=0,987 (95%CI: 0,975 – 0,994), respectively. Junior doctors achieved higher rates of correct identification than senior doctors both in the first and the second round (95% vs. 90% and 90% vs. 86.25%).

**Conclusion:** The COV is an easily reproducible radio-anatomical landmark allowing accurate identification of the anatomy of the GT. This should assist the operating surgeon to determine the correct entry point for intramedullary nailing, optimise implant positioning and might prevent implant-related complications. Hence, radio-anatomic education of surgeons could help improving the clinical results following proximal femoral nailing.

## Upper gastrointestinal tract

### Cost - benefit analysis of an enhanced recovery program for gastrectomy

V. Luzuy-Guarnero<sup>1</sup>, C. Gronnier<sup>2</sup>, S. Figueredo<sup>1</sup>, S. Mantziari<sup>1</sup>, M. Schäfer<sup>1</sup>, N. Demartines<sup>1</sup>, P. Allemann<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>2</sup>Department of Digestive Surgery, University Hospital of Bordeaux, Bordeaux, France

**Objective:** Enhanced recovery program (ERP) are nowadays widely used in surgery. They have been shown to decrease postoperative complications and length of hospital stay. In recent years, research on the financial impact of these protocols demonstrated cost reduction in colorectal, liver and pancreatic surgery. The present study aimed to assess the cost-effectiveness of ERP for both elective and emergency gastric surgery.

**Methods:** An ERP, based on the ERAS society guidelines for gastric surgery, has been implemented since June 2014 in our tertiary center. A prospective series of consecutive patients operated from June 2014 to December 2017 (ERAS group, n = 53), was compared to a control group (n = 63) who underwent laparoscopic or open gastric surgery from January 2010 to Mai 2014 without ERP. Primary outcome was the cost-effectiveness analyses including preoperative, intraoperative and postoperative detailed costs. Secondary endpoints were the overall morbidity and length of stay. A subgroup analysis assessed the costs according to the comprehensive complication Index (CCI).

**Results:** Both groups were comparable regarding demographic details. Overall complication rates in ERAS and control group (66% vs 64%, p=0.3) and length of stay (18 days vs 24 days, p=0.251) were similar. Mean overall costs per patient in the ERAS and control group were €36'881 and €55'178, but the difference was not statistically significant (p=0.371). Lower costs were found for intensive or intermediate care (-€7643), medication (-€1121), laboratory (-€1508) and blood transfusion (-€908). In patients with few or no complications (CCI < 20), the mean costs were lower in the ERAS group (€27'701 vs €31'455, p=0.04).

**Conclusion:** ERAS protocol are most cost-effective for gastric surgery in patients with no or few complications. The accruing costs for treating complications are so high, that the beneficial cost-effective effects of ERAS protocols are waived.

### Exploring postoperative decrease of albuminemia as predictor of complications after oncological esophagectomy: an international multicenter study

I. Labgaa<sup>1</sup>, S. Mantziari<sup>1</sup>, J. Pasquier<sup>2</sup>, M. Messier<sup>3</sup>, J.-A. Elliott<sup>4</sup>, S. Kamiya<sup>5</sup>, M.-C. Kalfp<sup>6</sup>, M. Winiker<sup>1</sup>, M. Hübner<sup>1</sup>, P. Allemann<sup>1</sup>, M.-I. van Berge Henegouwen<sup>6</sup>, M. Nilsson<sup>5</sup>, J. Reynolds<sup>4</sup>, G. Piessen<sup>3</sup>, N. Demartines<sup>1</sup>, M. Schäfer<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Lausanne University Hospital, Lausanne, Switzerland, <sup>2</sup>Institute of Social and Preventive Medicine (IUMSP), Lausanne University Hospital, Lausanne, Switzerland, <sup>3</sup>Department of Digestive and Oncological Surgery, University of Lille, Claude Huriez University Hospital, Lille, France, <sup>4</sup>Department of Surgery, Trinity Translational Medicine Institute, St. James's Hospital, Dublin, Ireland, <sup>5</sup>Department of Clinical Science, Intervention and Technology (CLINTEC), Division of Surgery, Karolinska Institutet, Stockholm, Sweden, <sup>6</sup>Department of Surgery, Academic Medical Center, Amsterdam, Netherlands

**Objective:** The predictive value of postoperative albuminemia decrease ( $\Delta$ Alb) has been increasingly evidenced in major surgery but data on esophagectomy remain scarce. This study aimed to assess the predictive value of  $\Delta$ Alb for adverse short-term outcomes after oncological esophagectomy.

**Methods:** Retrospective analysis of an international multicentric cohort of patients undergoing oncological esophagectomy between 2006-2017. Patients with missing pre- and postoperative albumin values were excluded from the analysis. Primary endpoint was postoperative complications according to Clavien classification. Secondary endpoints were Comprehensive Complication Index (CCI) and length of hospital stay (LoS).

**Results:** A total of 1046 patients were analyzed. Overall and major complications were reported in 889 (85%) and 363 (34.7%) patients, respectively. Albuminemia showed a rapid postoperative decrease on POD1 ( $\Delta$ Alb POD1) with a median value of 11 g/L. ROC curve analysis determined an ideal cut-off of 11 g/L for the prediction of overall complications. Patients with  $\Delta$ Alb POD1  $\geq$  11 g/L showed increased overall complications ( $p=0.004$ ), major complications ( $p=0.009$ ) and CCI ( $p=0.006$ ) while LoS was comparable ( $p=0.099$ ). On multivariable analyses,  $\Delta$ Alb POD1  $\geq$  11 g/L was an independent predictor of both overall complications (OR: 1.55; 95% CI 1.09-2.21;  $p=0.015$ ) and major complications (OR: 1.43; 95% CI 1.09-1.89;  $p=0.009$ ).

**Conclusion:** Oncological esophagectomy was followed by a rapid decrease of albuminemia.  $\Delta$ Alb POD1  $\geq$  11 g/L was independently associated with overall and major postoperative complications.  $\Delta$ Alb appears as a promising biomarker to detect patients at higher risk of adverse outcomes after oncological esophagectomy.

196 → Wurde als Vortrag zurückgezogen

#### Post - operative dysphagia following magnetic sphincter augmentation for gastroesophageal reflux disease

C. Tsai<sup>1</sup>, R. Steffen<sup>1</sup>, H. Merki<sup>2</sup>, U. Kessler<sup>1</sup>, J. Lipham<sup>3</sup>, J. Zehetner<sup>1</sup>

<sup>1</sup>Department of Visceral Surgery, Hospital Hirslanden Beau-Site, Bern, Switzerland,

<sup>2</sup>Department of Gastroenterology, Hospital Hirslanden Beau-Site, Bern, Switzerland,

<sup>3</sup>General Surgery, Keck Medicine of the University of Southern California, California, USA

**Objective:** Gastroesophageal reflux disease (GERD) is the most prevalent gastrointestinal disorder of the esophagus in the Western population. Magnetic lower esophageal sphincter augmentation (MSA) is a treatment technique with promising results. Dysphagia is the most common temporary side effect after MSA, occurring in up to 83% of patients. While most cases self-resolve by 3 months, some persist and require intervention. The aim of this study was to evaluate predictors of persistent post-operative dysphagia leading to intervention, as well as its impact on quality of life.

**Methods:** From August 2015 to September 2018 we reviewed the electronic medical records of all patients with GERD receiving a laparoscopic MSA (LINX reflux management system, Torax Medical) with posterior cruroplasty (PC). Demographic details, procedure details and outcome variables were recorded. Pre- and post-operative GERD-HRQL scores were obtained to assess symptom response. Patients with post-operative dysphagia requiring balloon dilation were identified, and variables were analyzed to assess for risk factors.

**Results:** There were 118 patients (M=59, F=59) with GERD treated with MSA-PC. Mean age was 50 years (R18-80) and mean duration of symptoms was 10.4 years (R1-40). One patient was converted to a Nissen fundoplication for persistent GERD. Based on GERD-HRQL scores ( $n=73$  responses), 100% of patients had improved symptoms after MSA-PC. Post-operative dysphagia was present in 80 patients (67.8%). Of them, 20 (16.9%) required balloon dilation for persistent dysphagia. Patients received a median of 1 dilation at a mean of 5.6 months (R1-13) after MSA-PC. The MSA device was explanted in two patients, while dysphagia resolved in 15 patients. Two patients have persistent symptoms and the remaining patient has insufficient follow-up. Compared to patients who did not require dilation, dilated patients were more likely to have atypical GERD symptoms pre-operatively. However, 92.3% of non-explanted patients requiring dilation reported an improved quality of life.

**Conclusion:** Post-operative dysphagia after MSA-PC is a common temporary side effect and most commonly seen in patients with atypical GERD symptoms pre-operatively. Most cases of persistent dysphagia can be treated with a single balloon dilation. Despite requiring dilation, the majority of patients still report an improved quality of life.

#### Preemptive endoluminal vacuum therapy to reduce anastomotic leakage after esophagectomy: a game-changing approach?

C. Gubler<sup>1</sup>, D. Vetter<sup>2</sup>, H. M. Schmidt<sup>2</sup>, P. C. Müller<sup>2</sup>, B. Morell<sup>1</sup>, D. Raptis<sup>3</sup>, C. A. Gutschow<sup>2</sup>

<sup>1</sup>Department of Gastroenterology, University Hospital Zurich, Zurich, Switzerland,

<sup>2</sup>Department of Visceral and Transplant Surgery, University Hospital Zurich, Zurich, Switzerland,

<sup>3</sup>Department of HPB Surgery and Liver Transplantation, Royal Free London NHS Foundation Trust, London, United Kingdom

**Objective:** Endoluminal vacuum therapy (EVT) is an accepted treatment for anastomotic leakage (AL) after esophagectomy. A novel concept is to use this technology in a preemptive setting, with the aim to reduce AL rate and postoperative morbidity.

**Methods:** Between November 2017 and May 2018, preemptive EVT (pEVT) was performed intraoperatively in 19 consecutive patients undergoing minimally invasive esophagectomy, immediately after completion of esophago-gastrostomy. Twelve patients (63%) were high-risk cases with severe comorbidity. The EVT device was removed routinely three to six days after esophagectomy. Endpoints of this study were AL rate and postoperative morbidity.

**Results:** There were 20 anastomoses at risk in 19 patients. One patient (5.3%) experienced major morbidity (Clavien-Dindo grade IIIb) unrelated to anastomotic healing. He underwent open re-anastomosis at postoperative day 12 with pEVT for redundancy of the gastric tube and failure of transition to oral diet. Mortality after 30 days was 0% and anastomotic healing was uneventful in 19/20 anastomoses (95%). One minor contained AL healed after a second course of EVT. Except early proximal dislodgement in one patient, there were no adverse events attributable to pEVT. The median comprehensive complication index 30 days after surgery was 20.9 (IQR 0-26.2).

**Conclusion:** Preemptive endoluminal vacuum therapy is a safe procedure that may reduce AL formation and related morbidity by promoting primary anastomotic healing. Furthermore, pEVT is likely to seal potential minor full-thickness defects at a very early stage and thereby prevent free leakage in patients undergoing esophagectomy.

## Vessel

#### Catheter foam sclerotherapy: a valid and safe alternative for small saphenous vein incontinence

F. Strano, A. Huot, C. Bron, H. Probst

Department of Visceral Surgery, Hospital EHC of Morges, Morges, Switzerland

**Objective:** Endovenous thermal ablation therapy for varicose veins is nowadays a well established alternative to conventional surgery with similar short and medium term results. Catheter foam sclerotherapy (CFS) is also recommended as a safe therapy for incompetent saphenous veins (GRADE 1A). Although this treatment has a higher recurrence rate compared to the other procedures. Adjuncts as intra-saphenous saline irrigation (ISI) and peri-saphenous tumescence (PST) were recently described to improve its outcomes. As small saphenous vein (SSV) treatment is often altered by neurological complications, we consider this new technique in this specific indication. The purpose of this study is to assess the safety and short-term results of this procedure in the SSV treatment.

**Methods:** Retrospective monocentric analysis was carried out between March 2017 and December 2018.

30 consecutive patients with SSV incompetence were enrolled and submitted to CFS, after ISI and PST. By means of peri-operative venous ultrasound (US), Lauromacrogol (400) 1% sclerosant foam was injected directly in SSV trunk through a long introducer. The surgical gesture was completed with phlebectomies. At the end of the procedure each patient worn an elastic bandage and injected subcutaneously low-molecular-weight-heparine for 10 days. Post-operative clinical and duplex US control were performed at 10 days and 6 months.

**Results:** 30 patients were available for follow-up at 10 days and 6 months. The occlusion rate in the respectively periods was 100%. The main complications were bruising and local pain in the areas of phlebectomies treated with NSAI

and local cooling. No nervous injuries, no infection neither phlebitis were observed.

**Conclusion:** CFS applied to small saphenous vein gives promising results as other endovenous procedure in term of safety and occlusion rate at short term. This procedure could be considered a good alternative for SSV incompetence lowering the neurological complication rate.

### Colonic ischemia after endovascular aortic repair

A. Sommerau, S. Hofer, K. Pavotbawan, M. Furrer

Department of Surgery, Vascular Unit, Cantonal Hospital of Graubünden, Chur, Switzerland

**Objective:** Colonic ischemia (CI) after endovascular aortic repair (EVAR) in abdominal aortic aneurysm is a rare but severe complication. Several risk factors have been described, but their significance is unclear. Our aim was to analyse patient characteristics, presentation and outcome of CI after EVAR in our institution.

**Methods:** From June 2008 until December 2018 we performed 232 EVAR in patients with elective or ruptured abdominal aneurysm. We reviewed all patients regarding postoperative colon ischemia. Different predictors such as comorbidities, hypogastric (HA) and visceral artery patency, previous colon surgery, surgery time, severe intraoperative hypotension and blood loss were analysed in the patients with CI. The van Walraven comorbidity score (vWcs) was used for measuring patients individual risk.

**Results:** Two patients (0.9%) out of 232 developed a severe CI. None had previous colon surgery. In both patients one HA was occluded, the vWcs was high and surgery time was long with over 380 minutes. Additionally to the occluded HA, the first patient showed a stenosis of the superior mesenteric artery. During the procedure he had a relevant blood loss resulting from perforating the left common iliac artery. The blood pressure during this period did not fall below 80 mmHg. Additionally, a thrombosis in the remaining open left HA occurred. CI was diagnosed on day five and the patient died one day after hemicolectomy.

The second patient had an additional aneurysm of the right HA. EVAR and an iliac branch stentgraft implantation on the right side were performed without any complications. Preservation of the right HA was achieved. On day two CI was diagnosed and treated by hemicolectomy, but the outcome was fatal because of a severe sepsis.

Astonishingly, the postoperative CT scan of both patients showed an endoleak type II caused by a lumbar artery and the open inferior mesenteric artery. Microembolisms could not be detected in the histologic assessment of the removed left colon.

**Conclusion:** Predictability of CI after EVAR is challenging. The relevance of patency of HA and main visceral arteries remains unclear and may increase in combination with additional predictors. In patients showing several predictors as high vWcs, long operating times and HA occlusion, the threshold to rule out CI should be low to prevent late diagnosis and fatal outcome.

### Early outcomes after branched and fenestrated endovascular aortic repair in octogenarians

V. Makaloski<sup>1,2</sup>, T. Kölbl<sup>2</sup>, T. Wyss<sup>1</sup>, J. Schmidli<sup>1</sup>

<sup>1</sup>Department of Cardiovascular Surgery, Inselspital, University Hospital of Bern, University of Bern, Bern, Switzerland, <sup>2</sup>Department of Vascular Medicine, German Aortic Center, University Heart Center Hamburg-Eppendorf, Hamburg, Germany

**Objective:** To compare early outcome after complex endovascular aortic repair in octogenarians (age  $\geq 80$  years) versus non-octogenarians (age  $< 80$  years) treated with fenestrated or branched stent-grafts.

**Methods:** Single-center retrospective analysis from a prospectively collected database of all patients undergoing repair with fenestrated or branched stent-grafts for para/suprarenal aortic aneurysm, type Ia endoleak after previous endovascular aortic repair and thoraco-abdominal aortic aneurysm (TAAA) between January 2015 and December 2017. All patients were divided in two groups, non-octogenarians (age  $< 80$  years) and octogenarians (age  $\geq 80$  years) at the time of repair. Outcomes were the difference between the groups in all-cause mortality, major adverse events and need for re-intervention

at 30-days. Preoperative and procedural variables were examined in a multiple logistic regression model as potentially associated factors with 30-day all-cause mortality.

**Results:** 207 patients [58 (28%) females] with median age of 73 years (IQR 68-78) underwent repair with fenestrated or branched stent-grafts. There were 169 (81%) non-octogenarians with a median age of 72 years (IQR 65-76) and 38 (19%) octogenarians with a median age of 82 years (IQR 81-84). Seventeen patients (five elective, twelve urgent procedures) died during 30-days (8%). Mortality rate was higher in the octogenarians [11 (7%) vs. 6 (16%),  $P = .09$ ]. Two patients in each group had early stent-graft related re-interventions. Seven patients (one octogenarian) needed surgical revision of the common femoral artery and five patients (all non-octogenarians) of the right-sided brachial artery. Similar rates of postoperative sepsis, respiratory problems, renal function deterioration, spinal cord injury were found in both groups. After multiple logistic regression ASA class  $\geq 4$ , TAAA and rupture were independent factors for 30-day all-cause mortality.

**Conclusion:** Complex endovascular repair in octogenarians has a trend to higher 30-day all-cause mortality compared with non-octogenarians without reaching significance. Age  $\geq 80$  year was not found to be an independent predictor for higher 30-day all-cause mortality.

### Endograft sizing in patients with RAAA

M. Gajic<sup>1,2</sup>, D. Jaeger<sup>1</sup>, H. Székessy<sup>1</sup>, M. Lachat<sup>1</sup>, Z. Rancic<sup>1</sup>

<sup>1</sup>Department of Vascular Surgery, University Hospital Zurich, Zurich, Switzerland,

<sup>2</sup>Department of Vascular Surgery, Cantonal Hospital of Lucerne, Lucerne, Switzerland

**Objective:** Ruptured abdominal aortic aneurysm (RAAA) untreated is fatal. Whether open surgery or emergent endovascular (eEVAR) is the preferable treatment is an ongoing debate. Due to appropriate perioperative management of the patient and clearly defined standardized operating procedure successful outcomes are shown. Five key elements are crucial for treatment of an RAAA by eEVAR: Hemodynamics, Imaging, Procedure, Abdominal Compartment Syndrome and Teamwork. Hemodynamics is comprised of hypotensive hemostasis by permissive hypovolemia and controlled hypotension. Sizing in eEVAR procedure is performed in hypotensive patients. The objective of our study is to investigate changes in aortic diameter in hypotensive patients with RAAA.

**Methods:** Included are all patients with RAAA treated by eEVAR at our institution during the period 2003-2015. Inclusion criteria are systolic blood pressure below or equal 100 mmHg at CTA used for sizing. Patients had a thoracoabdominal CTA at admission, after intervention, at 3 and 12 months postoperative. Exclusion criteria were RAAA treated with complex endovascular aneurysm repair and those with incomplete CTA data. Measurements in axial plane at different levels according to predefined protocol was done.

**Results:** Maximum change of the diameter in percentage at 12 months compared to admission was: at the level of external iliac artery (+13%), aortic arch (+11%) and common iliac artery (+8%). The difference of the ascending aorta compared to admission was +6%, descending aorta +5% and 1cm above lower renal artery +6%.

**Conclusion:** The diameter of the aorta and the iliac arteries in the CTA in patients with RAAA is influenced by hemodynamic changes during permissive hypovolemia and controlled hypotension. The most significant decrease of the mean diameter, in our cohort, is observed in the external iliac artery (13%) and the common iliac artery (8%).

In patients with RAAA and systolic blood pressure below or equal to 100 mmHg, the decrease in diameter of the aorta might result in inadequate sizing of the stent grafts during eEVAR. Further analysis of the clinical implications of over- or undersizing will be examined on secondary interventions and the follow-up period.

### Mid-term results comparing endovascular asymptomatic popliteal aneurysm repair versus open bypass surgery

K. Pavotbawan<sup>1</sup>, M. Furrer<sup>1</sup>, U. Derungs<sup>2</sup>, S. Hofer<sup>1</sup>

<sup>1</sup>Department of Surgery, Vascular Surgery Unit, Cantonal Hospital Graubünden, Chur, Switzerland, <sup>2</sup>Department of Surgery, Vascular Surgery Unit, Cantonal Hospital Glarus, Glarus, Switzerland

**Objective:** According to the data in the literature endovascular treatment of popliteal aneurysm seems to be associated with lesser patency rates compared to bypass surgery. The aim of this study was to assess the outcome in our cohort comparing both treatment strategies.

**Methods:** Between January 2014 and December 2017, we treated 27 popliteal aneurysms. Symptomatic patients were excluded. After evaluating the patients risk factors, we performed either femoral-popliteal bypass using autologous reversed vein under general anesthesia or endovascular repair using VIABAHN stentgraft (W. L. Gore & Associates, Inc.) under local anesthesia. Patients were assessed 3 months and 1 year after surgery. Early results and follow up data were analyzed regarding surgery time, complication, length of stay and patency rate.

**Results:** 48% of the patients underwent endovascular repair (ER) and 52% were treated by open surgery (OS). Mean age was 77.6 (ER) vs. 66.5 (OS). The preoperative ASA score was significantly higher in the ER group (2.92 vs. 2.50,  $p < 0.05$ ). Three anastomotic aneurysms after previous bypass surgery were treated endovascularly. Surgery time (65min vs. 180min,  $p < 0.05$ ) and length of stay (5.15d vs. 8.42d,  $p = 0.079$ ) was shorter in the ER group. Postoperative complications were two hemorrhages, one in each group. Primary assisted patency was 84% (ER) versus 93% (OS) after 3 months and 84% (ER) versus 86% (OS) after 12 months. The secondary patency rate was lower in the ER group, after 3 months 85% (ER) versus 93% (OS) and 1 year 71% (ER) versus 93% (OS).

**Conclusion:** Reintervention and graft thrombosis were more likely after endovascular repair. Therefore, open surgery is the preferable strategy in younger patients. In patients at risk, i.e. with high ASA score and with previous bypass surgery, endovascular popliteal aneurysm repair seems to be a good therapeutic alternative.

### Open repair of mycotic abdominal aortic aneurysms with biological grafts: an international multicenter study

I. Heinola<sup>1</sup>, K. Söreljus<sup>2</sup>, T. Wyss<sup>3</sup>, N. Eldrup<sup>4</sup>, N. Settembre<sup>5</sup>, C. Setacci<sup>6</sup>, K. Mani<sup>2</sup>, I. Kantonen<sup>1</sup>, M. Venermo<sup>1</sup>

<sup>1</sup>Department of Vascular Surgery, University of Helsinki and University Hospital Helsinki, Helsinki, Finland, <sup>2</sup>Section of Vascular Surgery, Uppsala University, Uppsala, Sweden, <sup>3</sup>University Department of Cardiovascular Surgery, Inselspital, University Hospital of Bern, Switzerland, <sup>4</sup>Department of Cardiothoracic and Vascular Surgery, University Hospital Aarhus, Aarhus, Denmark, <sup>5</sup>Department of Vascular Surgery, University Hospital Nancy, Nancy, France, <sup>6</sup>Department of Medical Sciences, Surgical and Neuroscience, University of Siena, Siena, Italy

**Objective:** The treatment of mycotic abdominal aortic aneurysm requires surgery and antimicrobial therapy. Since prosthetic reconstructions carry a considerable risk of reinfection, biological grafts are noteworthy alternatives. The current study evaluated

the durability, infection resistance, and midterm outcome of biological grafts in treatment of mycotic abdominal aortic aneurysm.

**Methods:** All patients treated with biological graft in 6 countries between 2006 and 2016 were included. Primary outcome measures were 30- and 90-day survival, treatment-related mortality, and reinfection rate. Secondary outcome measures were overall mortality and graft patency.

**Results:** Fifty-six patients (46 males) with median age of 69 years (range 35–85) were included. Sixteen patients were immunocompromised (29%), 24 (43%) had concomitant infection, and 12 (21%) presented with rupture. Bacterial culture was isolated from 43 (77%). In-situ aortic reconstruction was performed using autologous femoral veins in 30 patients (54%), xenopericardial tube-grafts in 12 (21%), cryopreserved arterial/venous allografts in 9 (16%), and fresh arterial allografts in 5 (9%) patients. During a median follow-up of 26 months (range 3 weeks–172 months) there were no reinfections and only 3 patients (5%) required assistance with graft patency. Thirty-day survival was 95% ( $n = 53$ ) and 90-day survival was 91% ( $n = 51$ ). Treatment-related mortality was 9% ( $n = 5$ ). Kaplan–Meier estimation of survival at 1 year was 83% (95% confidence interval, 73%–94%) and at 5 years was 71% (52%–89%).

**Conclusion:** Mycotic abdominal aortic aneurysm repair with biological grafts is a durable option for patients fit for surgery presenting an excellent infection resistance and good overall survival.

### Risk factors and indications for removal of totally implantable venous-access ports in oncological and non-oncological patients

R. Fahrner, F. Schenker, F. Rauchfuss, U. Settmacher

Department of General, Visceral and Vascular Surgery, University Hospital Jena, Jena, Germany

**Objective:** Totally implantable venous-access ports (TIVP) play an important role in the treatment of oncological but also in non-oncological patients. Although these devices are considered as the safest way of long-term central venous access, complications and adverse events are often seen and the removal of the TIVP is necessary. The aim of this investigation was to analyse the patient cohort undergoing TIVP removal in our surgical department.

**Methods:** Patients undergoing TIVP removal between January 2004 and December 2016 were retrospectively analysed regarding patients characteristics, underlying disease, indications, and TIVP related factors.

**Results:** During the investigated time period in total 3166 TIVP and 609 TIVP removals (19%) were performed. 53% of patients undergoing TIVP removal were initially treated in our department, the others were treated in external hospitals or other institutions (other surgical specialties, radiology). There was an increase of TIVP removals during the investigated time period. Organ-related malignancy ( $n = 348$ , 57%) was more frequently seen than hematologic malignant diseases ( $n = 122$ , 20%) or non-oncological diseases. The mean time span between implantation and removal was 19.2 months, interestingly 14.5% of removals were performed during the first month after TIVP insertion. The majority of TIVP were inserted on the right side (74%), and 314 TIVPs were inserted by open cut-down approach (52%) with cephalic vein as predominant vessel (52%). A high proportion of patients (62%) were still under running chemotherapy. The majority of removals were performed due to TIVP related infections (58.3%), followed by TIVP related complications in 21% (dislocation, dysfunction, thrombosis) or end of treatment (15.9%). Patients with running chemotherapy were more likely to get a TIVP infection than patients without chemotherapy ( $p < 0.001$ ). In the majority of infectious complications staphylococcus species were isolated either from the blood stream or surgical swabs (62.3%), followed by gram-negative bacilli (12.3%) or fungi (9.7%).

**Conclusion:** Infectious complications after TIVP implantations are frequent. An important risk factor for mainly staphylococcus associated infections seems to be running chemotherapy. Therefore, strict adherence to a sterile technique during implantation and during manipulation of TIVP devices are important issues to prevent infectious complications.