

# SIES 2018

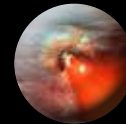
**SIES** Sydney International  
Endoscopy Symposium

## 11th SYDNEY INTERNATIONAL ENDOSCOPY SYMPOSIUM

*Incorporating the  
Westmead Endoscopy Symposium Nurses' Workshop  
and Mini Symposium: Controversies in GI Endoscopy*

**Wednesday 21, Thursday 22 and Friday 23 March, 2018**





ICC Sydney



[www.sies.org.au](http://www.sies.org.au)

## CONFERENCE PROGRAM AND SYLLABUS

### SIES INTERNATIONAL FACULTY

-  Prof Pradeep Bhandari, UK
-  Prof Paul Fockens, The Netherlands
-  A/Prof Steven Heitman, Canada
-  Prof Prateek Sharma, USA

### TOPICS INCLUDE

- Colonoscopy
- Approach to serrated polyps, serrated dysplasia and neoplasia in 2018
- Best practice polypectomy
- New methods in advanced tissue resection: EMR and ESD
  - Enhanced imaging and optical diagnosis
  - GI stricture management
  - Palliation of malignant luminal obstruction
  - ERCP: complex and basic therapeutics
  - Direct cholangioscopy
- Balloon enteroscopy
- Treatment of achalasia including POEM
- Endoscopic treatment of perforations and fistulas
- Endoscopic ultrasound
- Barrett's Oesophagus
  - Detection of inconspicuous neoplasia and dysplasia
  - Endoscopic treatment for dysplasia and early cancer in 2018

ICC Sydney has two car parks, providing patrons with access to a total of 826 parking bays, 365 days a year, 24 hours each day. The entrances to the car parks can be easily found by heading south along Darling Drive. Signage will assist and indicate how many bays are available or if the car park is full. **Delegates of SIES are recommended to use the car park located beneath the Exhibition Centre (P1).**

**ACCESS PLAN  
GROUND LEVEL**

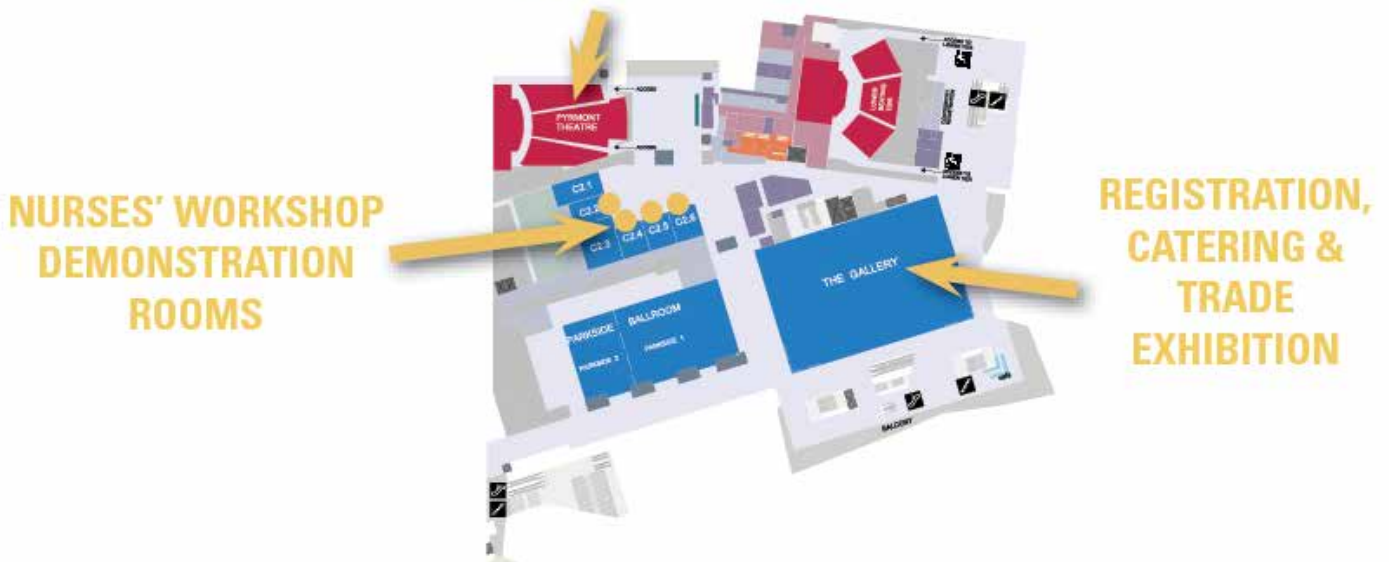
**ACCESS PLAN  
GROUND LEVEL**

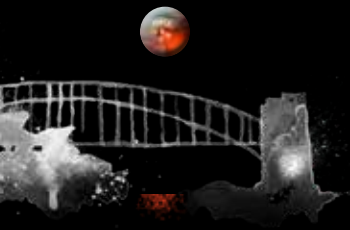


SIES will be held on Level 2 of the “Conventions” precinct of ICC Sydney. Registration, catering and the trade exhibition will be in “The Gallery”. The plenary (for both the Nurses’ Workshop and SIES) will be in the “Pyrmont Theatre”. Signage and concierge staff in the foyer of ICC Sydney will assist you with directions if needed.

**LEVEL TWO FLOORPLAN**

**SIES** Sydney International Endoscopy Symposium





# WELCOME



Dear Colleagues and Friends,

On behalf of our department, it is my great pleasure to welcome you to the 11th annual Sydney International Endoscopy Symposium. We will again aim to provide a comprehensive demonstration of diagnostic and therapeutic endoscopy. Your support and enthusiasm has been overwhelming and this year will be our largest and I believe our most successful event yet.

The Symposium's content has been carefully designed to facilitate discussion. Please utilise the Symposium App via your mobile device to relay your questions through the chairs to our proceduralists. This is a unique feature that will enhance the interaction between the expert faculty and the audience. A strong emphasis on the cognitive processes behind the delivery of high quality endoscopy will feature. Several novel technologies will also be demonstrated.

On behalf of our Department, Nurses and Doctors alike, I thank you for your support and for interrupting your busy schedules to join us here for these three special days. I believe the international guests, in combination with our Australian faculty and the team from Westmead, will provide an enlightening and informative educational experience for you.

Please enjoy!


Yours sincerely

**Michael Bourke**

Chairman Sydney International Endoscopy Symposium 2018  
Director of Gastrointestinal Endoscopy,  
Westmead Hospital, Sydney

## MARK YOUR DIARY

SIES 2019 - Wednesday 13, Thursday 14 and Friday 15 March, 2019

ICC Sydney 

| MARCH 2019 |    |    |    |    |    |    |
|------------|----|----|----|----|----|----|
| S          | M  | T  | W  | T  | F  | S  |
|            |    |    |    |    | 1  | 2  |
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| 10         | 11 | 12 | 13 | 14 | 15 | 16 |
| 17         | 18 | 19 | 20 | 21 | 22 | 23 |
| 24         | 25 | 26 | 27 | 28 | 29 | 30 |
| 31         |    |    |    |    |    |    |



# SIES 2018 APP

Download the official smartphone app for SIES 2018!

Kindly brought to you by Olympus.



Log on to the ICC's WiFi:  
**SydneyEndoscopy2018**

WiFi Access Code: **sies2018**

Available to you at no cost as a SIES delegate, our APP puts the event in the palm of your hand! This year we are using a new app platform, that allows seamless integration with your registration details and offers great in-app features as always.

You can use the app to plan your time in advance, decide what you want to see and do, and also use it to:

- Discover the conference program and floorplan
- Access speaker bios, abstracts and presentations
- See profiles of all exhibitors and their staff and have access to additional information and documents
- Keep up with real time alerts, news and tweets during the show in the EventStream and post comments, photos and videos
- Exchange contact details with other attendees and exhibitors
- Find the people you're looking for and send meeting requests
- Participate in live polling, live feedback (Q&A) and much more!

## LIVE POLL AND Q&A FEATURES!

Ask questions in-session on the fly. Questions are moderated by the speaker/chair and can be answered by the panel or passed on to the Endoscopists at Westmead.

# WIN!



## INITIAL INSTALLATION

In your device's iOS or Android AppStore search for **The Event App by EventsAir** and download the free app.



If you have a Blackberry or Windows device you can access the app by scanning this QR code, or typing into your browser



<https://ekiddna.eventsair.com/attendeeapp/sies2018/sies2018/>

Enter the event code **SIES2018** and you will be able to log in via the gold key icon.



Use your **registered email address** and your personal **4 digit pin** you will have received in your welcome email. If you are not able to locate the email, just visit the App Concierge Desk for assistance.

Once you have completed these initial steps you will be logged in for the duration the conference and beyond and you will receive updates and alerts automatically.

**Visit the App Concierge at the Olympus stand to view the EventStream and App Participation Leaderboard!**

**EACH DAY WE WILL AWARD A PRIZE FOR THE MOST ENGAGED PARTICIPANT IN THE APP.**

Conditions: Simply use your SIES App (to ask questions, share information, make comments and more) to go into the draw to win a \$250 eftpos card!



#sies2018

**REGISTER YOUR INTEREST IN THE OLYMPUS MOTORISED SPIRAL ENDOSCOPY SYSTEM VIA THE SIES APP\***

**WIFI CODE**  
sies2018

**APP CONCIERGE**

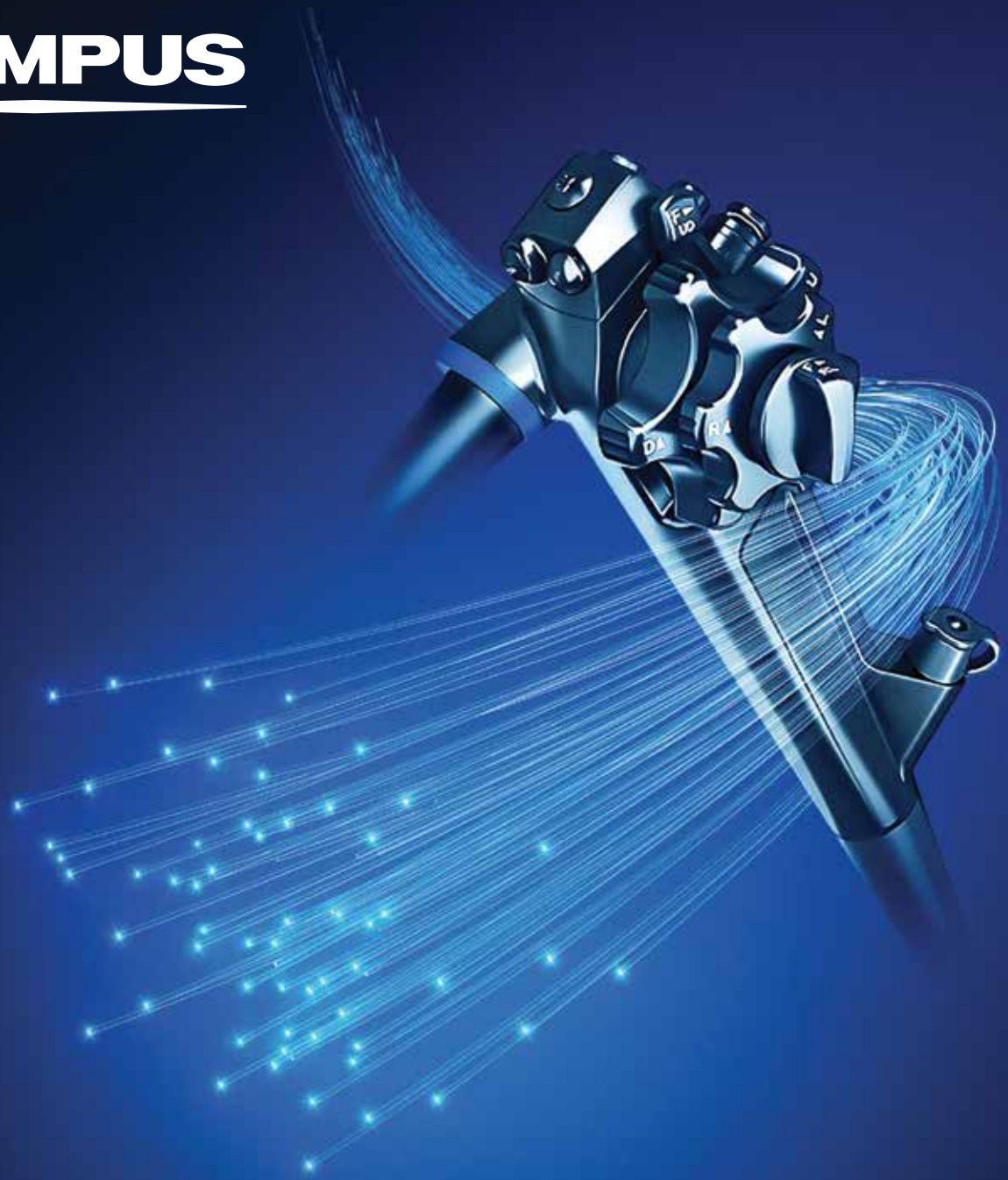
**ASK US HOW**  
Log on to the ICC's WiFi: SydneyEndoscopy2018  
WiFi Access Code: sies2018

**BE PART OF THE APP FOR 2018. PARTICIPATE AND WIN!**

- 1 Go to the App Store on your device and search for The Event App by EventsAir. For Blackberry or Windows devices scan this barcode.
- 2 Once you have downloaded the App enter in the Event Code: SIES2018.
- 3 Login to the app using your email address and the 4 digit pin sent in your welcome email.

\*The Olympus Motorised Spiral Endoscopy System has not yet received CE mark approval. The device will be available for use at the discretion of the manufacturer.

# OLYMPUS



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# INTERNATIONAL FACULTY



## PROFESSOR PRADEEP BHANDARI

Spire Portsmouth  
Hospital, Havant,  
UK

Prof Pradeep Bhandari runs a tertiary referral centre for GI neoplasia at Queen Alexandra Hospital, Portsmouth. His expertise is in GI neoplasia assessment and resection with techniques like EMR, ESD, FTRD and third space endoscopy. He has a special interest in Barrett's neoplasia and pioneered the use of acetic acid in assessment of Barrett's. He has several peer reviewed publications and member of various International Endoscopy societies. He is a specialist advisor to NICE, HTA and various NIHR funding bodies. His motto is to constantly push the boundaries of endoscopy.



## PROFESSOR PAUL FOCKENS

University of  
Amsterdam,  
The Netherlands

Paul Fockens, MD PhD FASGE, is Professor and Chair of Gastroenterology & Hepatology at the Academic Medical Center at the University of Amsterdam. He is the current vice-president of the UEG and is a former president of the European Society of Gastrointestinal Endoscopy. His research interests are advanced diagnostic and therapeutic endoscopy. He focusses on colorectal, duodenal and pancreato-biliary neoplasia, pancreatitis and pancreatic fluid collections, EUS and advanced therapeutic interventions such as POEM in achalasia. His research

is clinical as well as more translational with use of the AMC animal facility for acute and survival studies. In his capacity as chairman of the European Postgraduate Gastro-Surgical School, he organises an annual EUS course since 20 years (next EUS-course June 2018) as well as Amsterdam Live Endoscopy, an annual course attracting 500+ participants each year ([www.amsterdamendoscopy.com](http://www.amsterdamendoscopy.com)), since 11 years. He is married, has two children and enjoys running and cycling. He has authored over 400 publications and is editor of two textbooks.



## A/PROF STEVEN HEITMAN

University of  
Calgary, Canada

Dr Steve Heitman is Associate Professor of Medicine at the University of Calgary, Cumming School of Medicine. He is presently the Medical Director of the Forzani & MacPhail Colon Cancer Screening Centre and is also the Director of the Advanced Endoscopy Training Program at the University of Calgary.

Dr Heitman currently holds the N.B. Hershfield Professorship in Therapeutic Endoscopy. He is a health services researcher with expertise in health economics. Dr Heitman's research is focussed in the areas of colon cancer screening, colonoscopy outcomes and quality and advanced endoscopy. He has published over 50 peer reviewed publications and has served as a reviewer for several leading journals.

Dr Heitman is also actively involved in endoscopy education and participates regularly as faculty at colonoscopy upskilling courses across Canada.



## PROFESSOR PRATEEK SHARMA

Kansas School of  
Medicine, Kansas  
City, USA

Prateek Sharma, M.D. is Professor of Medicine in the Division of Gastroenterology and Hepatology, and the Director of the Fellowship Training Program at the University of Kansas School of Medicine, Kansas City, USA. He received his Bachelor of Medicine and Bachelor of Surgery degrees from M.S. University of Baroda India, completed his Internal Medicine Residency at the Medical College of Wisconsin in Milwaukee and his Gastroenterology Fellowship at the University of Arizona in Tucson. Dr Sharma's research has focused on Barrett's esophagus, esophageal cancer gastroesophageal reflux disease and evaluating novel imaging techniques for upper and lower gastrointestinal diseases.

He has over 350 publications including original articles and book chapters related to these topics and has presented at major national and international meetings. He serves as a reviewer for most of the major medicine and gastroenterology subspecialty journals. Dr Sharma is a Fellow of the American College of Gastroenterology and the American College of Physicians, and has received the American College of Gastroenterology Governors Award for Excellence in Clinical Research. Dr Sharma has been interviewed by the Wall Street Journal and Newsweek. Dr Sharma is currently a member of the Governing Board of the American Society of Gastrointestinal Endoscopy.

The attendance of the international faculty has been graciously supported by our Platinum Sponsors



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Fluoroscopic image courtesy of Giuseppe Aliperti, MD  
St. Louis, Missouri.

\*Benchtop test data on file at Cook Medical.

# NURSES' WORKSHOP



## WELCOME TO NURSES

It is a great pleasure to welcome you to the 11th annual Westmead Endoscopy Symposium Nurses' Workshop.

The Westmead Endoscopy team has prepared another exciting and interesting array of talks and hands-on demonstrations that will complement and increase your knowledge, skills and understanding in interventional Endoscopy. As in years past the topics are not only very interesting but diverse, with topics on quality and evidence-based endoscopy, cancer screening plus bronchoscopy presentations in the Endoscopy suite and more.

As professional nurses we want to keep our skills and knowledge current and be actively seeking to build our competence to provide excellence in care. The Nurses' Workshop offers just that from the hands of expert nurses and doctors handling the various endoscopy devices during the popular demonstration stations. There will be lots of hands-on opportunities to try the common devices and also the latest ones on the market.

I want to take this opportunity to thank all who have been coming every year to support us and continue to build on the networking and interaction amongst the gastroenterology nurses. Learning and sharing fresh tips and tricks and collective experiences will enable us to provide excellence in Endoscopy.

Nurses are encouraged to attend the mini-symposium after tea and the following two full days live high quality transmission from the Westmead Endoscopy Suite to the International Convention Centre Sydney, which will showcase the latest development with interesting and challenging cases, which demonstrate the skills and wisdom of the internationally renowned guest faculty.

CPD points will be available for nurses attending the Workshop and Symposium.

Yours sincerely

### **Mary Bong**

Nurse Unit Manager Endoscopy Unit,  
Westmead Hospital Organising Committee,  
Sydney International Endoscopy Symposium, Nurses' Workshop 2018



Welcome to the 2018 Sydney International Endoscopy Symposium – Nurses' Workshop Program.

This program has been a success in previous years, and I would like to express a warm welcome to you all this year. I hope this will be an unprecedented experience that will allow you to gain valuable knowledge, skills and insights that you can apply in your areas of practice.

Westmead Hospital supports initiatives that further the professional development of nurses, and I am proud to support Westmead nurses in their journey to becoming leaders in gastrointestinal endoscopy.

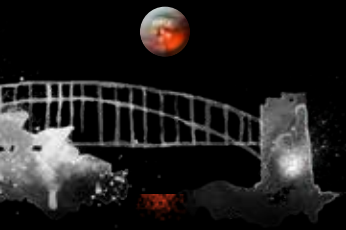
These initiatives will help us better serve our community with safe, high quality Gastroenterology and Endoscopy services.

The Nurses' Workshop program promises to provide us with an inspiring combination of interactive demonstrations and innovative presentations. The activities today will help us build local and international networks and a culture of collaboration. Every opportunity should be taken to ensure we spend time gathering our collective experience and inspiring each other to provide the best possible care for our patients.

Regards,

### **Kate Hackett**

Director of Nursing and Midwifery  
Westmead Hospital




# NURSES' WORKSHOP PROGRAM

## WEDNESDAY 21 MARCH 2018 – The Pymont Theatre

|   |   |
|---|---|
| 0730  | Registration opens and arrival tea/coffee amongst the trade displays in The Gallery |
| 0830 - 0845   | Welcome note<br>Mary Bong NUM and Kate Hackett DON, Westmead Hospital               |
| <b>SECTION 1 Facilitators: Mary Bong NUM, Robyn Brown CNE and Dr Naaz Sidhu</b> |   |
| 0845 - 0915   | <i>Colorectal cancer screening in the frigid north</i> – A/Prof Steve Heitman       |
| 0915 - 0945   | <i>Bronchoscopy patient presentations - interventions</i> – Dr David Michail        |
| 0945 - 1015   | <i>Evidence based endoscopy</i> – Kathleen Goodrick RN                              |
| 1015 - 1100   | Morning tea and trade displays in The Gallery                                       |

This program is endorsed by the Westmead Hospital and 8 CPD points are awarded



|   |   |
|---|---|
| <b>SECTION 2 Facilitators: Judith Tighe-Foster CNS, Susan Lane RN and Dr Nick Burgess</b> |   |
| 1100 - 1130   | <i>Quality in endoscopy</i> – Dr Nick Burgess                   |
| 1130 - 1145   | <i>Quiz</i> – Alison Bannister RN                               |
| 1145 - 1215   | <i>EUS based extra luminal interventions</i> – Dr Ji Young Bang |
| 1215 - 1245   | <i>Quiz prizes</i>  |
| 1245 - 1345   | Lunch and trade displays in The Gallery                         |


Certificates of Attendance for the Nurses' Workshop, will be available for self-collection outside the 'Demonstration Rooms' (from lunchtime until the end of the day).

### SECTION 3 Demonstrations C2.2, C2.3, C2.5 and C2.6 rooms Co-ordinators: Judith Tighe-Foster CNS, Susan Lane RN and Dr Nick Burgess

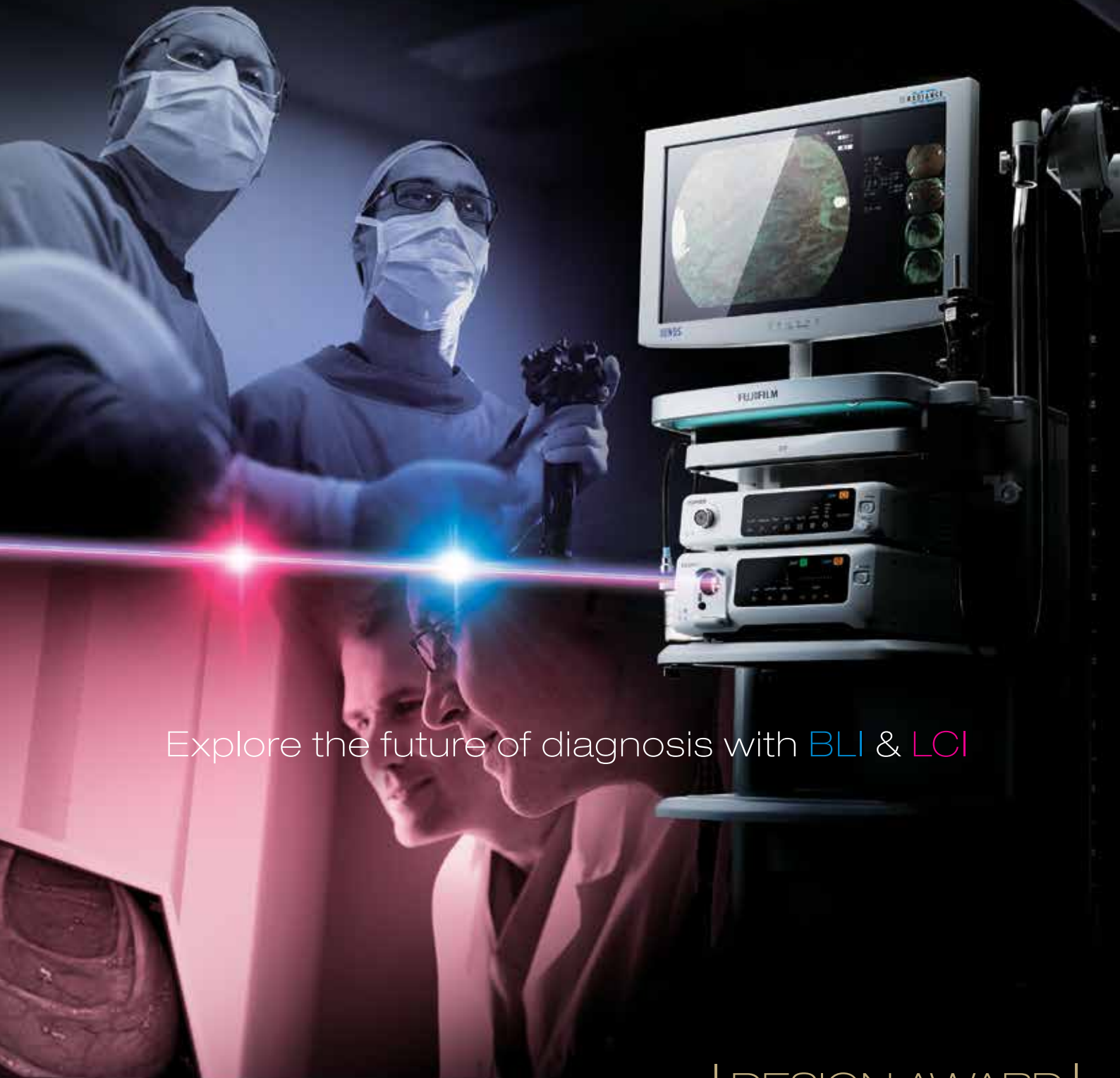
|  | Demonstration 1<br>Co-ordinator: Judith Tighe-Foster CNS                                    | Demonstration 2<br>Co-ordinator: Susan Lane RN  |
|--|---|---|
| 1345 - 1530<br><br>(8 minutes at each table) | Table 1. <i>EUS devices</i> : Marriam Khilwati RN, Su Wang RN and Dr Nick Burgess           | Table 1. <i>Bowel Cancer screening: Nurse led service</i> Betty Lo CNC  |
|  | Table 2. <i>ERCP devices</i> : Dr Naaz Sidhu, Kaysey Rial EEN and Zion Siu Kwok RN          | Table 2. <i>Update on CPE and infection control guidelines and hand hygiene</i> : Robyn Brown CNE and Alison Bannister RN       |
|  | Table 3. <i>Bronchoscopy devices</i> : Jeneviah Junio RN and Monica Gautam Karki RN         | Table 3. <i>Intra procedural patient care in 2018</i> : Susan Lane RN and Kathleen Goodrick RN                                  |
|  | Table 4. <i>Achalasia and POEM set up</i> : Judith Tighe-Foster CNS and Nicky Stojanovic RN | Table 4. <i>Radiation safety</i> : Lucy Cartwright (Medical Physics Specialist) and John Crancher (Radiation Safety Technician) |

1530 - 1610 Afternoon tea and trade displays in The Gallery

### MINI SYMPOSIUM: CONTROVERSIES IN GI ENDOSCOPY (The nursing delegates will this year join together with the medical delegates for a joint session of video and discussion on polyp removal techniques)

|             |  |
|-------------|--|
| 1610 - 1715 | <i>Video based interactive case discussion with the expert panel</i> – Prof Pradeep Bhandari, Prof Paul Fockens, A/Prof Steve Heitman, Prof Prateek Sharma   |
| 1715 - 1815 | Closing Drinks Function in The Pymont Theatre foyer<br>All delegates are invited to our Wednesday Closing Drinks Function kindly brought to you by  |

- DEMONSTRATION STATIONS - what you need to know!**
- There will be 4 Workshop Rooms to visit and these will be located in the rooms across the foyer from where the Nurses' Workshop is being held. Your name badge will be colour coded (red, yellow, green or blue) to represent the group you have been allocated to. The red group will start at C2.2 the yellow group will start at C2.3, the green group will start at C2.5, and the blue group will start at C2.6, Groups will then be rotated after 25 minutes.
  - For each room there will be several demonstration stations. Demonstrations will take approximately 8 minutes. You will be required to break into smaller groups in each room for the demonstration booths.
  - A reminder will be given after 25 minutes and you will rotate to the next demonstration room in your colour groups.
  - Please follow the Facilitators' (Westmead Hospital staff) instructions when moving from demonstration stations and booth to booth.



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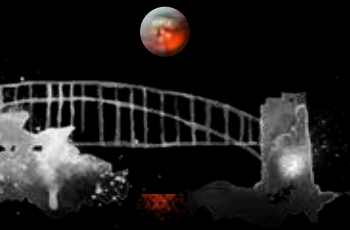
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• BL-7000/VP-7000  
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# MINI SYMPOSIUM: Controversies in GI Endoscopy

Featuring the world's foremost experts in an interactive format

## WEDNESDAY 21 MARCH 2018 – The Pymont Theatre

|             |   |
|-------------|---|
| 1300 - 1400 | Registration and lunch amongst the trade exhibitions in The Gallery   |
| 1400 - 1420 | <i>Barrett's low grade dysplasia: relax or resect?</i> – Prof Prateek Sharma  |
| 1420 - 1440 | <i>Proton pump inhibitors, gastric cancer risk and the rest! Fact or fiction?</i> – Prof Emad El Omar   |
| 1440 - 1500 | <i>Medical management of acute pancreatitis 2018: Insights from the Dutch pancreatitis study group</i> – Prof Paul Fockens  |
| 1500 - 1530 | Panel Discussion  |
| 1530 - 1610 | Afternoon tea and trade displays in The Gallery   |
| 1610 - 1715 | <i>Video based interactive case discussion with the expert panel</i> – Prof Pradeep Bhandari, Prof Paul Fockens, A/Prof Steve Heitman, Prof Prateek Sharma  |
| 1715 - 1815 | Closing Drinks Function in The Pymont Theatre foyer<br>All delegates are invited to our Wednesday Closing Drinks Function<br><br>kindly brought to you by  |

## SIES Sydney International Endoscopy Symposium

SIES 2018 has been approved in the RACS CPD Program. Fellows who participate can claim one point per hour in Maintenance of Knowledge and Skills. Participation in this activity will be populated into your RACS CPD Online, please simply notify the registration desk that you authorise your details to be uploaded with the RACS for this process.



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### DIETARY MEALS AT SIES

If you have advised the Conference organisers (at the time of your registration) of your dietary needs, then this has been noted and passed onto the venue. There will be a dedicated dietary buffet within the trade exhibition area for each catering break, please make yourself known to the staff and they will be more than willing to look after you.

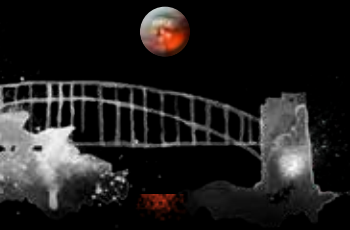
# SYMPOSIUM PROGRAM



## THURSDAY 22 MARCH 2018 – The Pyrmont Theatre

|  |  |
|--|--|
| 0730   | Registration opens and arrival tea/coffee amongst the trade displays in The Gallery  |
| 0830-0835  | Official conference open and welcome – Prof Michael Bourke   |
| <b>RICHARD HOPE MINI SYMPOSIUM: Optimising Everyday Endoscopy</b><br>CHAIR: Dr Steve Williams      |  |
| 0835-0855  | <i>Detecting and characterising UGI dysplasia (stomach and squamous oesophagus)</i> – Prof Pradeep Bhandari                                  |
| 0855-0915  | <i>Challenging colon polyps: Scarred lesions, recurrence, etc. ‘little things to achieve success’</i> – Dr Nick Burgess                      |
| 0915-1030  | <b>LIVE ENDOSCOPY 1</b><br>CHAIRS: Dr Steve Williams, Dr Milan Bassan, Dr Michael Swan   |
| 1030-1110  | Morning tea and trade displays in The Gallery  |
| 1110-1300  | <b>LIVE ENDOSCOPY 2</b><br>CHAIRS: A/Prof David van der Poorten, Prof Raj Singh, A/Prof Alan Moss  |
| 1300-1410  | Lunch and trade displays in The Gallery  |
| 1410-1520  | <b>LIVE ENDOSCOPY 3</b><br>CHAIRS: Dr Robert Cheng, Dr Simon Zanati, Dr Farzan Bahin   |
| 1520-1600  | Afternoon tea and trade displays in The Gallery  |
| <b>SIES STATE OF THE ART LECTURE 1</b>   |  |
| 1600-1620  | <i>Barrett’s Oesophagus 2018: What we don’t know but should</i> – Prof Prateek Sharma  |
| 1620-1640  | <i>General endoscopy quiz (prizes awarded on Friday afternoon)</i> – Dr Naaz Sidhu   |
| <b>MINI SYMPOSIUM: Challenges in Colonoscopy</b>   |  |
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| 1640-1700  | <i>Colonoscopy quality: Why it really matters, more than you know</i> – A/Prof Steve Heitman   |
| 1700 - 1720  | <i>Chronic colitis and CRC risk: Screening for prevention?</i> – Prof Paul Fockens   |
| 1720 - 1740  | <i>Chronic colitis and CRC risk: Medical therapy for prevention?</i> – A/Prof Susan Connor   |
| 1740 - 1800  | <i>Panel Discussion</i>  |
| 1800   | 1800 CLOSE<br><b>1815 Boarding HMAS SIES at Convention Jetty – Must depart by 1830</b>   |
| 1900 - 2130  | Official Symposium Reception – Museum of Contemporary Art Australia ‘Sculpture Terrace’<br><i>Refer to next page for further information</i> |

Certificates of Attendance for the delegates attending SIES will be automatically emailed next week.



## SYMPOSIUM RECEPTION

**Venue:** Museum of Contemporary Art Australia  
'Sculpture Terrace' – Level 4

**Date:** Thursday 22nd March, 7.00pm – 9.30pm

**Cost:** \$95 per delegate

**Inclusions:** Gourmet substantial canapés, drinks and return cruise boat transfers

The Museum of Contemporary Art Australia, boasts spectacular views of the world famous Sydney Opera House and Harbour Bridge.



### Welcome aboard HMAS SIES!

CRUISE BOAT FORWARD TRANSFER

Boarding: 6.15pm @ Convention Jetty

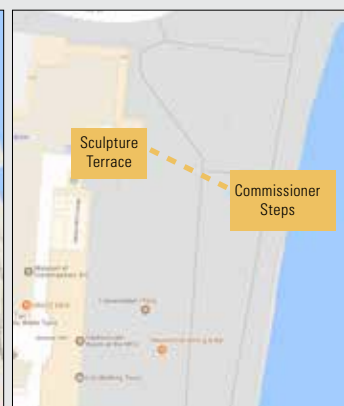
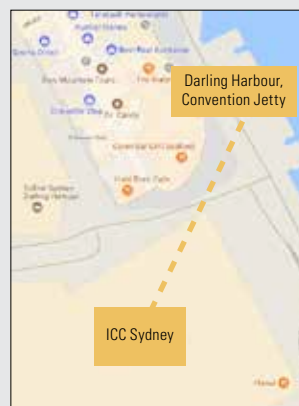
Must depart by 6.30pm

Disembark: 7.00pm @ Commissioner Steps

CRUISE BOAT RETURN TRANSFER

Boarding: 9.30pm @ Commissioner Steps

Disembark: 9.45pm @ Convention Jetty



## FRIDAY 23 MARCH 2018 – The Pyrmont Theatre

|  |  |
|--|--|
| 0800                                   | Registration opens and arrival tea/coffee amongst the trade displays in The Gallery  |
| <b>SIES STATE OF THE ART LECTURE 2</b> |  |
| 0830 - 0850                            | <i>The malignant colonic polyp: Predicting and managing before and after resection. How little do we know?</i> – Prof Pradeep Bhandari   |
| 0850 - 0900                            | <i>Panel Discussion</i>  |
| 0900 - 1030                            | <b>LIVE ENDOSCOPY 4</b><br>CHAIRS: Dr Rita Lin, Dr Mark Appleyard, Dr Frank Weilert  |
| 1030 - 1110                            | Morning tea and trade displays in The Gallery  |
| 1110 - 1300                            | <b>LIVE ENDOSCOPY 5 including clinical update:</b><br><i>Management of Pancreatic fluid collections. Best practice 2018</i> – Dr Ji Young Bang<br>CHAIRS: Dr Thao Lam, Dr Nick Tuticci, A/Prof William Tam |
| 1300 - 1410                            | Lunch and trade displays in The Gallery  |
| 1410 - 1545                            | <b>LIVE ENDOSCOPY 6</b><br>CHAIRS: Dr Eric Lee, Dr Matthew Remedios, Dr Darren Pavey   |
| 1545 - 1600                            | Quiz answers and awards for the winners – Dr Naaz Sidhu<br>Summary and meeting close – Prof Michael Bourke   |

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# ABSTRACTS

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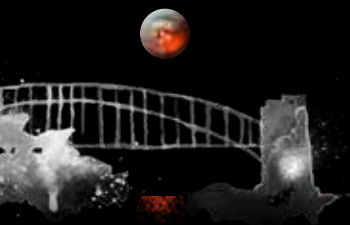
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# ABSTRACTS (in order of program)

**WEDNESDAY 21 March 2018**

## **NURSES' WORKSHOP**

### ***Colorectal cancer screening in the frigid north***

**Steve Heitman, MD, MSc, FRCPC**  
**University of Calgary, Canada**

All 13 provinces and territories in Canada either have or are planning formal colorectal cancer (CRC) screening programs. In the province of Alberta CRC screening remains opportunistic, yet recent data suggests that screening uptake is increasing. In 2013, the faecal immunochemical test (FIT) replaced guaiac-based faecal occult blood (gFOB) as the preferred method for screening Albertans at average risk for CRC. Persistent challenges include the use of FIT outside the target age population, among symptomatic patients and prior to recommended surveillance intervals following colonoscopy.

The Forzani & MacPhail Colon Cancer Screening Centre (CCSC) is a high-volume outpatient endoscopy unit in Calgary, Alberta, Canada. The CCSC is dedicated to the provision of CRC-screening related services to residents of Calgary. Approximately 17,000 colonoscopies are completed annually at the CCSC by a group of gastroenterologists and colorectal surgeons. Patients are prioritized according to risk and scheduled from a common queue, and thus endoscopists perform a similar case mix. The CCSC is uniquely structured with most of its operations conducted by allied health professionals and specifically, registered nurses. Guided by detailed algorithms, nurses triage referrals, perform pre-colonoscopy medical assessments and determine colonoscopy surveillance intervals following review of pathology and consideration of baseline CRC-risk in keeping with contemporary guidelines. Large polyps are managed centrally by a group of advanced endoscopists who also participate in a multi-disciplinary meeting. The CCSC has a robust quality assurance program. Endoscopists receive regular performance evaluation reports and all adverse events are tracked and reviewed.

### ***Bronchoscopy patient presentations - interventions***

**David Michail, MBBS, FRACP**  
**Westmead Hospital, Sydney**

Bronchoscopy is now a common procedure in many endoscopy units, with increasingly specialised procedures being undertaken, including endobronchial ultrasound guided procedures, and "hot and cold" techniques such as diathermy and cryotherapy increasingly used. Patient complexity for those undergoing the procedures is also increasing, with implications for management and safety. In this talk we will review several varying patient presentation scenarios, potential interventions, and briefly review the nursing safety and procedural facilitation aspects around these presentations.

### ***Evidence Based Endoscopy***

**Kathleen Goodrick, RN**  
**Westmead Hospital, Sydney**

An introduction to understanding evidenced based practice and how it shapes our endoscopic practices. This talk will cover a short history of developments in endoscopy, steps to develop a research project from identifying a problem, coming up with a plan, obtaining ethics and governance approval. We'll then discuss several clinical trials that have shaped and changed our evidenced based practice.

### ***Quality in Endoscopy***

**Nicholas Burgess BSc, MBChB, FRACP, PhD**  
**Westmead Hospital, Sydney**

The delivery of endoscopy services is a multifaceted process with significant administrative, technical, clinical and communication complexity. Quality in health care centres around six key elements: safety, effectiveness, patient-centered care, timeliness, efficiency and equity. Delivering care that addresses all of these elements is no mean feat and requires a broad approach. Quality targets may be set at the hospital, local health district, state or national level. Safety for example, not only refers to preventing medical adverse events, but must also address unit disaster planning and ensuring a safe workplace where occupational health hazards are reduced. Endoscopy units must comply with general quality standards however there are also several indicators which are specific to high quality clinical performance. The United Kingdom National Health Service (NHS) examined key quality indicators in endoscopy units and developed a Global Rating Scale (GRS) in 2004. This has since been adopted in several other countries including Canada and New Zealand. Reaccreditation using this system provides a formal method for maintaining minimum standards and driving improvement. Several international societies (BSG, ASGE, ESGE) have produced standards for quality and safety in endoscopy and delivery of services. In Australia, there are no centralized bodies monitoring overall endoscopy unit quality, so individual units must assess their current performance and processes and define standards to meet. National standards have been developed in infection control. A voluntary colonoscopist reaccreditation program has been developed by GESA and the Australian Commission on Safety and Quality in Healthcare is developing a clinical care standard for a national colonoscopy safety and quality model. Providing high quality care is essential for excellent clinical outcomes, but it also improves the endoscopy workplace and ensures patients are respected and prioritized. Accreditation in endoscopy is coming, so assessment of your existing quality processes is essential for the road ahead.

# ABSTRACTS

WEDNESDAY 21 March 2018

## MINI SYMPOSIUM:

### Controversies in GI Endoscopy

#### *Barrett's low grade dysplasia: relax or resect?*

Prateek Sharma, MD

University of Kansas School of Medicine, Kansas City, USA

Esophageal cancer in patients with Barrett's esophagus (BE) is believed to develop through stepwise histological stages of non-dysplastic BE, low grade (LGD), high grade dysplasia (HGD), and, ultimately, adenocarcinoma. Patients with non-dysplastic BE (NDBE) have a reported low annual rate for EAC progression of 0.33% (95% CI 0.28-0.38),<sup>[8]</sup> while those with HGD have a higher risk of developing EAC, with an annual rate of progression estimated up to 5-10%. There are at least two challenges associated with the histological diagnosis of LGD, first that it could be microscopically indistinguishable from inflammation and second that the concordance among pathologists regarding the criteria for LGD is low. Not surprisingly, a recent systematic review report highly variable rates of neoplastic progression in patients from LGD, ranging from 0.4 to 13.4%. A 2017 study showed poor inter-observer agreement, particularly for LGD ( $\kappa=0.11$ ), despite a two-step study design in which histopathologic criteria were developed with consensus and tested among seven pathologists from USA and Europe. Interestingly, the study found a higher concordance rate among European versus American pathologists. Studies have shown confirmation of BE-LGD by greater than one expert pathologist and LGD being persistent on repeated endoscopy to be associated with a significantly higher risk of HGD/EAC progression. The optimal management of BE-LGD remains still dubious due to its highly variable natural course and continues to pose challenges in the global attempt to halt the development of EAC. Therefore, establishing an accurate diagnosis is pivotal in risk stratifying these patients. Data suggest this is best achieved by 1) confirmation of LGD by 1 or more additional pathologists with expertise in GI histology and 2) persistent dysplasia found on subsequent endoscopies. An exciting development on the diagnostic horizon is molecular biomarkers, though these have yet to be significantly validated to be implemented into clinical practice. In determining management of BE-LGD, "shared decision making" between patients and physicians is a very reasonable and appropriate approach, stressing the importance of the physician to know all available options and to bring these options to an open discussion with their patients.

#### *Medical management of acute pancreatitis 2018: Insights from the Dutch pancreatitis study group*

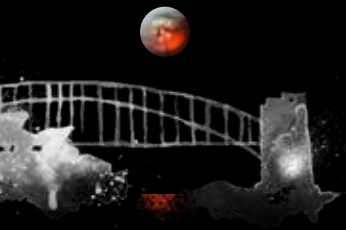
Paul Fockens, MD, PhD

University of Amsterdam, The Netherlands

The Dutch Pancreatitis Study Group is a group of surgeons, gastroenterologists and radiologists that have worked together for the past 15 years with the goal to perform prospective clinical research on the acute pancreatitis. The group is widely spread over the Netherlands and includes specialists from most large and academic hospitals. In the past decade large randomized clinical trials have been performed on subjects such as the optimal treatment of infected pancreatic necrosis, the value of early enteral feeding in predicted severe pancreatitis and the timing of cholecystectomy after mild biliary pancreatitis. The results of these trials have been incorporated in clinical guidelines all over the world and have changed management of our patients.

In patients with infected pancreatic necrosis, we have first shown that a step-up treatment starting with percutaneous drainage, gave better clinical results than laparotomy<sup>1</sup>. A subsequent trial compared step-up percutaneous drainage with endoscopic drainage and showed advantages for endoscopic drainage<sup>2</sup>. Another study compared early enteral feeding with on-demand feeding and did not find differences<sup>3</sup>. Finally, the study comparing same admission cholecystectomy with interval (4wks) cholecystectomy showed benefits of early cholecystectomy<sup>4</sup>.

1. Hjalmar C van Santvoort et al. A Step-Up Approach or Open Necrosectomy for Necrotizing Pancreatitis. *The New England Journal of Medicine* 362, no. 16 (April 22, 2010): 1491–1502, doi:10.1056/NEJMoa0908821.
2. Sandra van Brunschot et al. Endoscopic or Surgical Step-Up Approach for Infected Necrotising Pancreatitis: a Multicentre Randomised Trial. *Lancet* 391, no. 10115 (January 6, 2018): 51–58, doi:10.1016/S0140-6736(17)32404-2.
3. Olaf J Bakker et al. Early Versus on-Demand Nasoenteric Tube Feeding in Acute Pancreatitis. *The New England Journal of Medicine* 371, no. 21 (November 20, 2014): 1983–93, doi:10.1056/NEJMoa1404393.
4. David W da Costa et al. Same-Admission Versus Interval Cholecystectomy for Mild Gallstone Pancreatitis (PONCHO): a Multicentre Randomised Controlled Trial. *Lancet* 386, no. 10000 (September 26, 2015): 1261–68, doi:10.1016/S0140-6736(15)00274-3.



THURSDAY 22 March 2018

**Detecting and characterizing UGI dysplasia (stomach and squamous oesophagus)**

**Pradeep Bhandari, MBBS, MD, MRCP  
Queen Alexandra Hospital Portsmouth, UK**

Detection of upper Gi neoplasia is primarily dependent on the quality of Gastroscopy, training and experience of the Endoscopist. A drink containing mucolytic agents like Pronase or N-acetyl Cystiene and anti-bubble agent like Simethicone improves mucosal cleansing which should improve the chances of identifying subtle mucosal changes characteristic of dysplasia. Knowing patient's background risk profile is essential as that allows us to identify and pay attention to high risk stations like squamous oesophagus in patients with previous h/o Naso-Pharyngeal cancers and Gastric antrum and incisura in elderly patients of Far eastern origin or family h/o of Gastric cancer. Experienced endoscopist can see subtle mucosal changes like alteration in vessel pattern, colour changes (redness), lack of distensibility during inflation and deflation of stomach, mild oozing, convergence of folds etc. These are all signs of early Gi neoplasia and presence of any of these signs should lead the endoscopist to focus on that area and perform optical enhancement with conventional chromoscopy like Indigo carmine for stomach or Lugol's Iodine for squamous lined oesophagus. Indigocarmine is a contrast agent and enhances alterations in surface morphology and pit patterns which is commonly seen in gastric neoplasia. Lugol's Iodine gets absorbed by the glycogen in healthy squamous mucosa leading to a dark brown discolouration. However, areas affected by squamous neoplasia are depleted in glycogen and those areas do not absorb enough Lugol's Iodine resulting in a yellow, Lugol voiding spot. This colour contrast is very easy to identify with simple white light endoscopy.

Lesion characterization requires a lot of experience and advanced technology like a magnification endoscope and optical enhancement like NBI, BLI or I-scan. These technologies demonstrate subtle changes in surface vessel or pit patterns. Presence of neoplasia alters the surface vessel pattern. These patterns become more and more complex, irregular or lost as the depth of invasion of neoplasia increases. Recognition of these patterns is easier with a magnification endoscope and that would allow correct prediction of the depth of invasion of neoplasia in expert hands. I would elaborate on these techniques and technologies during my lecture.

**Challenging colon polyps: Scarred lesions, recurrence, etc. 'little things to achieve success'**

**Nicholas Burgess BSc, MBChB, FRACP, PhD  
Westmead Hospital, Sydney**

The majority of colon polyps are easily accessible,  $\leq 10$ mm in size and are simply and efficiently resected by adequately trained endoscopists. A smaller number of polyps are difficult. These polyps may be behind folds requiring patient or endoscope repositioning and retroflexion manoeuvres or may be larger, necessitating alterations to standard polypectomy techniques such as oligo-piecemeal EMR or prophylactic clips and loops. Flat lesions such as sessile serrated polyps may be difficult to ensnare. Challenging polyps are a level beyond difficult. These polyps have a significantly higher risk of technical failure, adverse events and recurrent or residual tissue at follow up. They require time, judgement and a range of techniques to ensure complete resection at the initial attempt. Challenging lesions may be bulky, widely spreading or circumferential, they may involve the ileocaecal valve, a diverticulum, the appendiceal orifice or the anal verge. Lesions with submucosal fibrosis or recurrent lesions that have been previously attempted or extensively biopsied may not lift well and have a high risk of perforation. Difficult, or even standard polyps can be converted into challenging polyps if they are incompletely resected, so careful assessment and selection of technique is required. The secret to success with many of these challenging lesions is to do the "small" things well. These are not aspects that require advanced equipment or extensive training, but are accessible, easily applied and in many cases proven to improve outcomes. Lesion assessment, care in basic polypectomy technique, approaches to fibrotic or non-lifting lesions, adjuvant thermal techniques to reduce recurrence, avoiding perforation, resection at the anal verge and appraisal of ileocaecal valve and appendiceal lesions is discussed. There are a wide range of challenging lesions and making a decision on attempting or referring a polyp is critical. These "small" assessment and resection tips may make decisions easier and improve resection outcomes.

1. Fahrtash-Bahin F, Holt BA, Jayasekeran V, et al. Snare tip soft coagulation achieves effective and safe endoscopic hemostasis during wide-field endoscopic resection of large colonic lesions (with videos). *Gastrointest Endosc* 2013;78:158–163.e1.
2. Burgess NG, Bassan MS, McLeod D, et al. Deep mural injury and perforation after colonic endoscopic mucosal resection: a new classification and analysis of risk factors. *Gut* 2017;66:1779–1789.
3. Tate DJ, Desomer L, Awadie H, et al. EMR of laterally spreading lesions around or involving the appendiceal orifice: technique, risk factors for failure, and outcomes of a tertiary referral cohort (with video). *Gastrointest Endosc* 2018:1–12.
4. Nanda K, Tutticci N, Burgess N, et al. Endoscopic mucosal resection of laterally spreading lesions involving the ileocaecal valve: technique, risk factors for failure, and outcomes. *Endoscopy* 2015;47:710–718.

# ABSTRACTS

5. Holt BA, Bassan MS, Sexton A, et al. Advanced mucosal neoplasia of the anorectal junction: endoscopic resection technique and outcomes (with videos). *Gastrointest Endosc* 2014;79:119–26.
6. Burgess NG, Bahin FF, Bourke MJ. Colonic polypectomy (with videos). *Gastrointest Endosc* 2015;81:813–835.
7. Tutticci N, Klein A, Sonson R, et al. Endoscopic resection of subtotal or completely circumferential laterally spreading colonic adenomas: technique, caveats, and outcomes. *Endoscopy* 2016;48:465–471.
8. Tutticci NJ, Hewett DG. Cold EMR of large sessile serrated polyps at colonoscopy (with video). *Gastrointest Endosc* 2018;87:688–694.e2.
9. Ferlitsch M, Moss A, Hassan C, et al. Colorectal polypectomy and endoscopic mucosal resection (EMR): European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline. *Endoscopy* 2017;49:270–297.
10. Tate DJ, Awadie H, Bahin FF, et al. Wide-field piecemeal cold snare polypectomy of large sessile serrated polyps without a submucosal injection is safe. *Endoscopy* 2017;248–252. 1–10

## **Barrett's Oesophagus 2018: What we don't know but should**

**Prateek Sharma, MD**  
**University of Kansas School of Medicine, Kansas City, USA**

Barrett's esophagus (BE) has long been known and proven to be a precursor to esophageal adenocarcinoma, a cancer associated with a high mortality once diagnosed. The management of Barrett's esophagus has come a long way since 1950, with the establishment of more specific criteria for its diagnosis, greater insight into the pathogenesis, and more aggressive guidelines with the aim of cancer prevention. The goal of cancer prevention can potentially be achieved by early, accurate diagnosis and more effective and efficient surveillance methods. An accurate diagnosis of early dysplastic disease is the first hurdle and can be helped by seeking histologic confirmation by a second pathologist. Studies have also shown that use of advanced imaging techniques including chromoendoscopy can be effective in the endoscopic inspection of intestinal metaplasia and neoplasia. Endoscopic therapy, which was initially reserved for a smaller sub-set of patients, is now being applied more judiciously and has shown excellent results. However, it is important to explain to patients that the treatment of dysplastic Barrett's requires commitment to several endoscopic procedures and many follow-up visits until eradication is achieved. Data in the form of randomized trials and high volume registries has provided good evidence to support the efficacy of these techniques and their long term durability. Recurrences though, have been reported post-ablation and thus surveillance post therapy is still recommended. Advances in the treatment of Barrett's offer hope and optimism to both gastroenterologists and patients, and with ongoing research in this field, will eventually eradicate this complex disease.

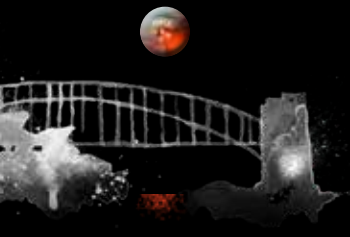
## **Colonoscopy quality: Why it really matters, more than you know**

**Steve Heitman, MD, MSc, FRCPC**  
**University of Calgary, Canada**

Quality matters! Whether within the foodservice, sporting or health care industry, consumers expect high quality performance. Consumers of health care, our patients deserve high quality care and health care systems should demand value for health care money.

Several colonoscopy quality indicators are associated with important health outcomes including the occurrence of and mortality from post colonoscopy cancers. Among these, the adenoma detection rate (ADR) has the strongest evidence base, but several shortcomings warrant consideration. ADR can be effected by procedure case mix, does not incorporate serrated lesions, is prone to the 'one and done' phenomenon and can even be gamed. While minimum ADR benchmarks have been promoted, ADR is inversely associated with the risk of interval cancers and a ceiling effect has not been demonstrated. Given geographic variation in colorectal cancer (CRC) incidence rates between and within countries, shouldn't ADR benchmarks similarly differ? To enhance CRC screening quality, endoscopists should be encouraged to elevate their ADR towards the true adenoma prevalence in the population they are serving rather than meet an arbitrary and historical minimum standard. On the other hand, an endoscopist's ADR is calculated from a limited sample, and is subject to error due to random variation. Thus, it may be more appropriate to consider confidence intervals when deciding whether a practitioner has achieved an ADR benchmark. Finally, ADR benchmarks have not been established in other settings such as patients with positive faecal occult blood tests.

Notwithstanding the many limitations of the ADR, we cannot overlook low adenoma detectors within CRC screening programs. Strategies for performance enhancement include passive audit and feedback, mandatory upskilling, financial incentives and even punitive measures. However, jurisdiction over credentialing is often complex and poorly understood and systems are generally not designed to manage isolated underperformance.



## **Chronic Colitis and CRC risk: Screening for prevention?**

**Paul Fockens, MD, PhD**  
**University of Amsterdam, The Netherlands**

It is well known that longstanding inflammation of the colon, such as in Ulcerative Colitis (UC) or Crohn's Disease (CD) increases the risk of developing colorectal cancer (CRC). The exact risk is unknown and dependent on many variables. Risk factors such as severity of symptoms, extent of the disease, intensity of inflammation, age at onset, concomitant PSC and familial risk of CRC, all contribute to the risk. Colonoscopy seems to be the preferred surveillance modality and most guidelines recommend regular colonoscopic surveillance starting 8 years after onset of the disease. The exact way to perform this surveillance, the target group for surveillance and the efficacy of surveillance are subject of continuous debate<sup>1</sup>.

In 2015 a consensus statement was published which gave practical recommendations in the absence of an abundance of large prospective studies on this subject<sup>2</sup>. This consensus recommended using high definition colonoscopes (use your best endoscope for these patients!), to always perform chromoendoscopy instead of white light alone and it stated that narrow band imaging (NBI) cannot replace chromoendoscopy at the current time. When neoplastic lesions are detected, an attempt at endoscopic removal in a tertiary referral center should be the first step. And when lesion(s) are completely removed, surveillance can continue instead of the advice in the past to perform a colectomy.

1. Hans-Olov Adami et al. The Continuing Uncertainty About Cancer Risk in Inflammatory Bowel Disease. *Gut* 65, no. 6 (June 2016): 889–93, doi:10.1136/gutjnl-2015-311003.

2. Loren Laine et al. SCENIC International Consensus Statement on Surveillance and Management of Dysplasia in Inflammatory Bowel Disease. *Gastroenterology* 148, no. 3 (March 2015): 639–651.e28, doi:10.1053/j.gastro.2015.01.031.

**FRIDAY 23 March 2018**

## **The malignant colonic polyp: Predicting and managing before and after resection. How little do we know?**

**Pradeep Bhandari, MBBS, MD, MRCP**  
**Queen Alexandra Hospital Portsmouth, UK**

Benign colonic polyps can be cured by endoscopic resection. Malignant polyps can be divided into two broad categories of those which can be cured by endoscopic resection (Good prognostic) and those which cannot be cured by endoscopic resection (Bad prognostic). The challenges for endoscopists resecting these polyps is first to differentiate malignant from non malignant polyps and next to differentiate good prognostic polyp cancer from bad prognostic polyp cancer before they attempt endoscopic resection. This is not always easy. Various endoscopic characteristics have been described to help endoscopists make such distinctions. These include bigger size, depressed areas (Paris IIc) in polyps, Abnormal pit patterns (Kudo's typeV), abnormal vessel patterns (NICE 3) and Non granular morphologic appearance of flat colonic polyps (LST-NG). Assessment of some of these features requires training, experience, high quality endoscopes, Optical enhancement technologies and dyes. A recent meta-analysis of world literature on EMR of polyps >20mm demonstrated a 7.8% prevalence of covert cancers in polyps presumed to be benign and resected by EMR (Hasan et al; *Gut* 2015). A similar review of world ESD literature demonstrated a 15.7% prevalence of covert cancers (Fuccio et al; *Gut* 2018). This review also reported that just over half (8%) of these cancers were SM-1 so potentially curable by ESD.

This suggests that even in expert hands there is 7-8% chance that pre-resection endoscopic assessment is likely to fail in polyps >20mm. The management of polyp cancers after endoscopic resection is always challenging and depends primarily on the quality of histology specimen and quality of Histology report.

If polyp demonstrates good prognostic features like well differentiated histology, depth of invasion less than 1000microns below the muscularis mucosae, lack of budding, absence of lympho-vascular invasion and R0 resection then surgery could potentially be avoided. The best way to manage these patients would be through Multi-disciplinary meetings. My lecture will explore all these aspects in greater details.

# KEY ABSTRACTS: COLON

*Endoscopy*. 2018 Jan;50(1):52-62. doi: 10.1055/s-0043-119215. Epub 2017 Oct 11.

**Cold-forceps avulsion with adjuvant snare-tip soft coagulation (CAST) is an effective and safe strategy for the management of non-lifting large laterally spreading colonic lesions.**

Tate DJ<sup>#1,2</sup>, Bahin FF<sup>#1,2</sup>, Desomer L<sup>#2</sup>, Sidhu M<sup>#2</sup>, Gupta V<sup>#2</sup>, Bourke MJ<sup>1,2</sup>.

## BACKGROUND AND AIMS:

Non-lifting large laterally spreading colorectal lesions (LSLs) are challenging to resect endoscopically and often necessitate surgery. A safe, simple technique to treat non-lifting LSLs endoscopically with robust long-term outcomes has not been described.

## METHODS:

In this single-center prospective observational study of consecutive patients referred for endoscopic mucosal resection (EMR) of LSLs  $\geq 20$  mm, LSLs not completely resectable by snare because of non-lifting underwent standardized completion of resection with cold-forceps avulsion and adjuvant snare-tip soft coagulation (CAST). Scheduled surveillance colonoscopies were performed at 4-6 months (SC1) and 18 months (SC2). Primary outcomes were endoscopic evidence of adenoma clearance and avoidance of surgery. The secondary outcome was safety.

## RESULTS:

From January 2012 to October 2016, 540 lifting LSLs (82.2%) underwent complete snare excision at EMR. CAST was required for complete removal in 101 non-lifting LSLs (17.8%): 63 naïve non-lifting lesions (NNLs; 62.7%) and 38 previously attempted non-lifting lesions (PANLs; 37.3%). PANLs were smaller ( $P < 0.001$ ) and more likely to be non-granular ( $P = 0.001$ ) than the lifting LSLs. NNLs were of similar size ( $P = 0.77$ ) and morphology ( $P = 0.10$ ) to the lifting LSLs. CAST was successful in all cases and adverse events were comparable to lifting LSLs resected by complete snare excision. Recurrence at SC1 was comparable for PANLs (15.2%) and lifting LSLs (15.3%;  $P = 0.99$ ), whereas NNLs recurred more frequently (27.5%;  $P = 0.049$ ); however, surgery was no more common for either type of non-lifting LSL than for lifting LSLs.

## CONCLUSION:

CAST is a safe, effective, and surgery-sparing therapy for the majority of non-lifting LSLs. It is easy to use, inexpensive, and does not require additional equipment.

*Gastroenterology*. 2017 Sep;153(3):732-742.e1. doi: 10.1053/j.gastro.2017.05.047. Epub 2017 Jun 2.

**Risk Stratification for Covert Invasive Cancer Among Patients Referred for Colonic Endoscopic Mucosal Resection: A Large Multicenter Cohort.**

Burgess NG<sup>1</sup>, Hourigan LF<sup>2</sup>, Zanati SA<sup>3</sup>, Brown GJ<sup>4</sup>, Singh R<sup>5</sup>, Williams SJ<sup>6</sup>, Raftopoulos SC<sup>7</sup>, Ormonde D<sup>7</sup>, Moss A<sup>8</sup>, Byth K<sup>9</sup>, Mahajan H<sup>10</sup>, McLeod D<sup>10</sup>, Bourke MJ<sup>11</sup>.

**BACKGROUND & AIMS:** Among patients with large colorectal sessile polyps or laterally spreading lesions, it is important to

identify those at risk for submucosal invasive cancer (SMIC). Lesions with overt endoscopic evidence of SMIC are referred for surgery, although those without these features might still contain SMIC that is not visible on endoscopic inspection (covert SMIC). Lesions with a high covert SMIC risk might be better suited for endoscopic submucosal dissection than for endoscopic mucosal resection (EMR). We analyzed a group of patients with large colon lesions to identify factors associated with SMIC, and examined lesions without overt endoscopic high-risk signs to determine factors associated with covert SMIC.

**METHODS:** We performed a prospective cohort study of consecutive patients referred for EMR of large sessile or flat colorectal polyps or laterally spreading lesions ( $\geq 20$  mm) at academic hospitals in Australia from September 2008 through September 2016. We collected data on patient and lesion characteristics, outcomes of procedures, and histology findings. We excluded serrated lesions from the analysis of covert SMIC due to their distinct phenotype and biologic features.

**RESULTS:** We analyzed 2277 lesions (mean size, 36.9 mm) from 2106 patients (mean age, 67.7 years; 53.2% male). SMIC was evident in 171 lesions (7.6%). Factors associated with SMIC included Kudo pit pattern V, a depressed component (0-IIc), rectosigmoid location, 0-Is or 0-IIa+Is Paris classification, non-granular surface morphology, and increasing size. After exclusion of lesions that were obviously SMIC or serrated, factors associated with covert SMIC were rectosigmoid location (odds ratio, 1.87;  $P = .01$ ), combined Paris classification, surface morphology (odds ratios, 3.96-22.5), and increasing size (odds ratio, 1.16/10 mm;  $P = .012$ ).

## CONCLUSIONS:

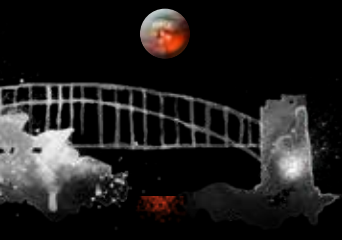
In a prospective study of 2106 patients who underwent EMR for large sessile or flat colorectal polyps or laterally spreading lesions, we associated rectosigmoid location, combined Paris classification and surface morphology, and increasing size with increased risk for covert malignancy. Rectosigmoid 0-Is and 0-IIa+Is non-granular lesions have a high risk for malignancy, whereas proximally located 0-Is or 0-IIa granular lesions have a low risk. These findings can be used to inform decisions on which patients should undergo endoscopic submucosal dissection, EMR, or surgery. ClinicalTrials.gov, Number: [NCT02000141](https://clinicaltrials.gov/ct2/show/study/NCT02000141)

*Endoscopy*. 2018 Mar;50(3):248-252. doi: 10.1055/s-0043-121219. Epub 2017 Nov 23.

**Wide-field piecemeal cold snare polypectomy of large sessile serrated polyps without a submucosal injection is safe.**

Tate DJ<sup>1,2</sup>, Awadie H<sup>2</sup>, Bahin FF<sup>1,2</sup>, Desomer L<sup>2</sup>, Lee R<sup>2</sup>, Heitman SJ<sup>2</sup>, Goodrick K<sup>2</sup>, Bourke MJ<sup>1,2</sup>.

**BACKGROUND AND STUDY AIMS:** Large series suggest endoscopic mucosal resection is safe and effective for the removal of large ( $\geq 10$  mm) sessile serrated polyps (SSPs), but it exposes the patient to the risks of electrocautery, including delayed bleeding. We examined the feasibility and safety of piecemeal cold snare polypectomy (pCSP) for the resection of large SSPs.



**METHODS:** Sequential large SSPs (10-35mm) without endoscopic evidence of dysplasia referred over 12 months to a tertiary endoscopy center were considered for pCSP. A thin-wire snare was used in all cases. Submucosal injection was not performed. High definition imaging of the defect margin was used to ensure the absence of residual serrated tissue. Adverse events were assessed at 2 weeks and surveillance was planned for between 6 and 12 months.

**RESULTS:** 41 SSPs were completely removed by pCSP in 34 patients. The median SSP size was 15mm (interquartile range [IQR] 14.5-20 mm; range 10-35mm). The median procedure duration was 4.5 minutes (IQR 1.4-6.3 minutes). There was no evidence of perforation or significant intraprocedural bleeding. At 2-week follow-up, there were no significant adverse events, including delayed bleeding and post polypectomy syndrome. First follow-up has been undertaken for 15/41 lesions at a median of 6 months with no evidence of recurrence.

**CONCLUSIONS:** There is potential for pCSP to become the standard of care for non-dysplastic large SSPs. This could reduce the burden of removing SSPs on patients and healthcare systems, particularly by avoidance of delayed bleeding.

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**Cold EMR of large sessile serrated polyps at colonoscopy (with video).**

Tutticci NJ<sup>1</sup>, Hewett DG<sup>2</sup>.

**BACKGROUND AND AIMS:** The optimal technique for the resection of sessile serrated polyps (SSPs) is unknown, with established limitations and risks with conventional polypectomy. Although cold snare polypectomy is safe, the efficacy of piecemeal resection for large lesions is untested. In this study we evaluate the safety and efficacy of cold EMR for large SSPs.

**METHODS:** Patients presenting for elective colonoscopy at an academic endoscopy center with 1 or more SSPs  $\geq 10$  mm in size were enrolled, excluding those on anticoagulant or antiplatelet therapy other than aspirin. Lesions were resected with a cold EMR technique comprising submucosal injection of succinylated gelatin and dilute methylene blue before piecemeal cold snare resection of all visible polyp with a margin of normal tissue. Outcomes were the presence of residual serrated neoplasia in biopsy specimens from the defect margin and findings on surveillance colonoscopy.

**RESULTS:** Cold EMR was performed on 163 SSPs during 105 procedures in 99 patients (97% women; median age, 57 years). The mean size was 17.5 mm: 61 SSPs were  $\geq 20$  mm and 13 SSPs  $\geq 30$  mm, and 97.5% were in the proximal colon. Cytologic dysplasia was present in 2 (1.2%). Margin biopsy specimens were positive in 2 lesions (1.2%). Surveillance colonoscopy for 82% of lesions (median, 5 months) showed residual serrated tissue in 1, treated with cold snare, but no evidence of recurrence in the remainder. Minor adverse events were seen in 3 patients; no delayed bleeding was observed.

**CONCLUSIONS:** Cold EMR is a safe and effective method for the removal of large SSPs.

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**812b A Multi-Center Randomized Control Trial of Thermal Ablation of the Margin of the Post Endoscopic Mucosal Resection (EMR) Mucosal Defect in the Prevention of Adenoma Recurrence Following EMR: Preliminary Results from the "SCAR" Study**

Amir Klein, Vanoo Jayasekeran, Luke F. Hourigan, David J. Tate, Rajvinder Singh, Gregor J. Brown, Farzan F. Bahin, Nicholas G. Burgess, Stephen J. Williams, Eric Y. Lee, Michael J. Bourke

**INTRODUCTION AND AIMS:** Endoscopic mucosal resection (EMR) of large sessile and lateral spreading colonic lesions  $\geq 20$  mm (LSLs) is safe and effective. The main limitation is adenoma recurrence, which occurs in up to 20% at first surveillance colonoscopy (SC1), mandating a structured surveillance program. Surveillance procedures create compliance burdens, additional costs and potential patient morbidity. Endoscopically invisible microadenoma present at the margin of the resected LSL may account for adenoma recurrence. Adjuvant thermal ablation of the EMR defect margin may reduce adenoma recurrence rates.

**METHODS:** A prospective multi-center randomized control study was performed (NCT01789749). The primary end-point was endoscopic and histological recurrence at SC1. Standard inject and resect EMR technique was used for all lesions. Exclusion criteria included previously attempted lesions, incomplete snare excision or involvement of the ileocaecal valve. After successful complete LSL excision by EMR and careful inspection of the defect to ensure no residual adenoma, mucosal defects were randomized 1:1 to either thermal ablation of the defect edges using snare tip soft coagulation (STSC) at 80w effect 4, or no additional treatment. SC1 was performed at 5-6 months, with standardized photo documentation and biopsies of the scar.

**RESULTS:** Over 32 months to January 2015, 768 lesions  $\geq 20$  mm were referred for EMR at 4 centers (407 were enrolled, 48 were later excluded, 359 were randomized (null arm n=178, active arm n=181)). Patient, procedure and lesion characteristics were similar between the two groups (Table 1). 267 (74.3%) patients have completed SC1. Endoscopic, and histologic recurrences at SC1 were significantly lower in the active arm (8/138 (5.8%) versus 26/129 (20.2%),  $p < .001$ , relative risk (RR)=0.29 (95% CI 0.14-0.61) and 6/104 (5.8%) versus 20/97 (20.6%),  $p=0.002$ , RR=0.28 (95% CI 0.12-0.67) respectively) (Table 2). Endoscopic assessment of the post EMR scar had a sensitivity of 100%, a specificity of 98% and a negative predictive value of 100% for correctly identifying recurrence when compared to histology results. There was no difference in the rate of delayed bleeding between the active and null groups (8/124 (6.5%) versus 9/136 (6.6%),  $p = .957$ ) and no difference in delayed perforation (0/124 (0%) vs 1/136 (0.7%),  $p=.341$ ).

**CONCLUSION:** Thermal ablation of the margin of the post EMR mucosal defect with STSC, results in significantly lower adenoma recurrence rates at first surveillance colonoscopy. Routine implementation of this simple and safe technique may enhance EMR efficacy and reduce surveillance requirements with fewer procedures and extended intervals.

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**The size, morphology, site, and access score predicts critical outcomes of endoscopic mucosal resection in the colon.**

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**BACKGROUND:** The SMSA (size, morphology, site, access) polyp scoring system is a method of stratifying the difficulty of polypectomy through assessment of four domains. The aim of this study was to evaluate the ability of SMSA to predict critical outcomes of endoscopic mucosal resection (EMR).

**METHODS:** We retrospectively applied SMSA to a prospectively collected multicenter database of large colonic laterally spreading lesions (LSLs)  $\geq 20$ mm referred for EMR. Standard inject-and-resect EMR procedures were performed. The primary end points were correlation of SMSA level with technical success, adverse events, and endoscopic recurrence.

**RESULTS:** 2675 lesions in 2675 patients (52.6% male) underwent EMR. Failed single-session EMR occurred in 124 LSLs (4.6%) and was predicted by the SMSA score ( $P < 0.001$ ). Intraprocedural and clinically significant postendoscopic bleeding was significantly less common for SMSA 2 LSLs (odds ratio [OR] 0.36,  $P < 0.001$  and OR 0.23,  $P < 0.01$ ) and SMSA 3 LSLs (OR 0.41,  $P < 0.001$  and OR 0.60,  $P = 0.05$ ) compared with SMSA 4 lesions. Similarly, endoscopic recurrence at first surveillance was less likely among SMSA 2 (OR 0.19,  $P < 0.001$ ) and SMSA 3 (OR 0.33,  $P < 0.001$ ) lesions compared with SMSA 4 lesions. This also extended to second surveillance among SMSA 4 LSLs.

**CONCLUSION:** SMSA is a simple, readily applicable, clinical score that identifies a subgroup of patients who are at increased risk of failed EMR, adverse events, and adenoma recurrence at surveillance colonoscopy. This information may be useful for improving informed consent, planning endoscopy lists, and developing quality control measures for practitioners of EMR, with potential implications for EMR benchmarking and training.

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**Wide-field endoscopic mucosal resection versus endoscopic submucosal dissection for laterally spreading colorectal lesions: a cost-effectiveness analysis.**

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**OBJECTIVE:** To compare the cost-effectiveness of endoscopic submucosal dissection (ESD) and wide-field endoscopic mucosal resection (WF-EMR) for removing large sessile and laterally spreading colorectal lesions (LSLs)  $> 20$  mm.

**DESIGN:** An incremental cost-effectiveness analysis using a decision tree model was performed over an 18-month time horizon. The following strategies were compared: WF-EMR, universal ESD (U-ESD) and selective ESD (S-ESD) for lesions highly suspicious for containing submucosal invasive cancer (SMIC), with WF-EMR used for the remainder. Data from a large Western cohort and the literature were used to inform the model. Effectiveness was defined as the number of surgeries avoided per 1000 cases. Incremental costs per surgery avoided are presented. Sensitivity and scenario analyses were performed.

**RESULTS:** 1723 lesions among 1765 patients were analysed. The prevalence of SMIC and low-risk-SMIC was 8.2% and 3.1%, respectively. Endoscopic lesion assessment for SMIC had a sensitivity and specificity of 34.9% and 98.4%, respectively. S-ESD was the least expensive strategy and was also more effective than WF-EMR by preventing 19 additional surgeries per 1000 cases. 43 ESD procedures would be required in an S-ESD strategy. U-ESD would prevent another 13 surgeries compared with S-ESD, at an incremental cost per surgery avoided of US\$210 112. U-ESD was only cost-effective among higher risk rectal lesions.

**CONCLUSION:** S-ESD is the preferred treatment strategy. However, only 43 ESDs are required per 1000 LSLs. U-ESD cannot be justified beyond high-risk rectal lesions. WF-EMR remains an effective and safe treatment option for most LSLs.

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**Endocuff-assisted vs. standard colonoscopy in the fecal occult blood test-based UK Bowel Cancer Screening Programme (E-cap study): a randomized trial.**

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**BACKGROUND AND STUDY AIMS:** Up to 25% colorectal adenomas are missed during colonoscopy. The aim of this study was to investigate whether the endocuff could improve polyp detection in an organized bowel cancer screening program (BCSP).

**PATIENTS AND METHODS:** This parallel group, single-blinded, randomized controlled trial included patients with positive fecal occult blood test (FOBT) who were attending for BCSP colonoscopy. The primary outcome was the number of polyps per patient. Secondary outcomes included the number of adenomas per patient, adenoma and polyp detection rates, and withdrawal times.

**RESULTS:** A total of 534 BCSP patients were randomized to endocuff-assisted or standard colonoscopy. The mean age was 67 years and the male to female ratio was 1.8:1. We detected no significant difference in the number of polyps per patient (standard 1.8, endocuff 1.6;  $P = 0.44$ ), adenomas per patient (standard 1.4, endocuff 1.3;  $P = 0.54$ ), polyp detection rate (standard 69.8%, endocuff 70.3%;  $P = 0.93$ ), adenoma detection rate (standard 63.0%, endocuff 60.9%;  $P = 0.85$ ), advanced adenoma detection rate (standard 18.5%, endocuff 16.9%;  $P = 0.81$ ), and cancer detection rate (standard 5.7%, endocuff 5.3%;  $P = 0.85$ ). The mean withdrawal time was significantly shorter among patients in the endocuff group compared with the standard colonoscopy group (16.9 vs. 19.5 minutes;  $P < 0.005$ ). The endocuff had to be removed in 17/266 patients (6.4%) because of inability to pass through the sigmoid colon.

**CONCLUSIONS:** This study did not find improved polyp or adenoma detection with endocuff-assisted colonoscopy in the FOBT-positive BCSP population. A shorter withdrawal time with endocuff may reflect improved views and stability provided by the endocuff. Trial registered at ClinicalTrials.gov (NCT02529007).

**Simple endoscopic treatment of adenoma recurrence after wide field endoscopic mucosal resection is effective: a prospective study of 1558 lesions with long term follow up**

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**INTRODUCTION:** Adenoma recurrence after wide field endoscopic mucosal resection (EMR) of laterally spreading colonic lesions  $\geq$  20mm (LSLs) is a major limitation. Data on the optimal methods and outcomes of endoscopic treatment of recurrence (ETOR) is absent and no evidence based standard exists. We examined the techniques and success of ETOR over time in a large prospective cohort.

**METHODS:** Over 100 months to January 2017 data on all recurrences after consecutive EMR procedures for LSLs at the lead centre of the Australian Colonic Endoscopic Resection Study (ACE) was recorded. Recurrence at the EMR scar was discerned using high definition endoscopic imaging as previously described<sup>1</sup>. ETOR comprised coagulation snare resection (ERBE Effect 2, 30W), cold avulsion forceps with adjuvant snare tip soft coagulation [CAST2] (ERBE Effect 4, 80W) or a combination of the two. The primary outcomes were complete adenoma clearance using ETOR at first surveillance (desired interval 4-6 months) and absence of recurrence at subsequent surveillance procedures.

**RESULTS:** 1558 patients with 1558 LSLs were included. 150 LSLs (9.6%) had recurrence at first surveillance colonoscopy. The mean age of patients with recurrence was 68 years and 55% were male. Recurrent LSLs were median 50mm in size (IQR 35-60mm) and located distal to the hepatic flexure in 52.7%. They were commonly of Paris 0-IIa+Is morphology (46.7%) and displayed tubulovillous adenoma at histopathology (75.3%), with high grade dysplasia in 23.3%. 4 (2.7%) were resected en-bloc. Recurrence at the EMR scar was  $\leq$  5mm in size (64%), unifocal (75%) and within the scar (55%) or at the edge (45%). The commonest modality used to resect recurrence was hot snare with adjuvant snare tip soft coagulation (35%). CAST was used in 30% and was also used in combination with hot snare (9%). CAST was more commonly used in the second temporal half (62.5%) than the first half (10.6%,  $p < .001$ ) of the cohort. Prior injection was performed in a minority (16%). In 124/143 (86.7%) cases where tissue was retrieved, there was histologic confirmation of recurrence.

**CONCLUSION:** ETOR achieved clearance of recurrent adenoma in 94.7% of cases at first surveillance colonoscopy with 8 (5.3%) referred for surgery primarily due to an inability to resect recurrence. For LSLs that underwent further surveillance, 89% (1 further surveillance), 86.5% (2 further surveillances) and 89.5% (3 further surveillances) respectively showed no evidence of recurrence.

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***A standardized imaging protocol for the endoscopic prediction of dysplasia within sessile serrated polyps (with video).***

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**BACKGROUND AND AIMS:** Dysplasia within sessile serrated polyps (SSPs) is difficult to detect and may be mistaken for an adenoma, risking incomplete resection of the background serrated tissue, and is strongly implicated in interval cancer after colonoscopy. The use of endoscopic imaging to detect dysplasia within SSPs has not been systematically studied.

**METHODS:** Consecutively detected SSPs  $\geq$  8 mm in size were evaluated by using a standardized imaging protocol at a tertiary-care endoscopy center over 3 years. Lesions suspected as SSPs were analyzed with high-definition white light then

narrow-band imaging. A demarcated area with a neoplastic pit pattern (Kudo type III/IV, NICE type II) was sought among the serrated tissue. If this was detected, the lesion was labeled dysplastic (sessile serrated polyp with dysplasia); if not, it was labeled non-dysplastic (sessile serrated polyp without dysplasia). Histopathology was reviewed by 2 blinded specialist GI pathologists.

**RESULTS:** A total of 141 SSPs were assessed in 83 patients. Median lesion size was 15.0 mm (interquartile range 10-20), and 54.6% were in the right side of the colon. Endoscopic evidence of dysplasia was detected in 36 of 141 (25.5%) SSPs; of these, 5 of 36 (13.9%) lacked dysplasia at histopathology. Two of 105 (1.9%) endoscopically designated non-dysplastic SSPs had dysplasia at histopathology. Endoscopic imaging, therefore, had an accuracy of 95.0% (95% confidence interval [CI], 90.1%-97.6%) and a negative predictive value of 98.1% (95% CI, 92.6%-99.7%) for detection of dysplasia within SSPs.

**CONCLUSIONS:** Dysplasia within SSPs can be detected accurately by using a simple, broadly applicable endoscopic imaging protocol that allows complete resection. Independent validation of this protocol and its dissemination to the wider endoscopic community may have a significant impact on rates of interval cancer.

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***Adenoma recurrence after piecemeal colonic EMR is predictable: the Sydney EMR recurrence tool.***

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**BACKGROUND AND AIMS:** EMR is the primary treatment of large laterally spreading lesions (LSLs) in the colon. Residual or recurrent adenoma (RRA) is a major limitation. We aimed to identify a robust method to stratify the risk of RRA.

**METHODS:** Prospective multicenter data on consecutive LSLs  $\geq$  20 mm removed by piecemeal EMR from 8 Australian tertiary-care centers were included (September 2008 until May 2016). A logistic regression model for endoscopically determined recurrence (EDR) was created on a randomly selected half of the cohort to yield the Sydney EMR recurrence tool (SERT), a 4-point score to stratify the incidence of RRA based on characteristics of the index EMR. SERT was validated on the remainder of the cohort.

**RESULTS:** Analysis was performed on 1178 lesions that underwent first surveillance colonoscopy (SC1) (median 4.9 months, interquartile range [IQR] 4.9-6.2). EDR was detected in 228 of 1178 (19.4%) patients. LSL size  $\geq$  40 mm (odds ratio [OR] 2.47;  $P < .001$ ), bleeding during the procedure (OR 1.78;  $P = .024$ ), and high-grade dysplasia (OR 1.72;  $P = .029$ ) were identified as independent predictors of EDR and allocated scores of 2, 1, and 1, respectively to create SERT. Lesions with SERT scores of 0 (SERT = 0) had a negative predictive value of 91.3% for RRA at SC1, and SERT was shown to stratify RRA to specific follow-up intervals by using Kaplan Meier curves (log-rank  $P < .001$ ).

**CONCLUSIONS:** Guidelines recommend SC1 within 6 months of EMR. SERT accurately stratifies the incidence of RRA after EMR. SERT = 0 lesions could safely undergo first surveillance at 18 months, whereas lesions with SERT scores between 1 and 4 (SERT 1-4) require surveillance at 6 and 18 months. (Clinical trial registration number: NCT01368289.)

**Deep mural injury and perforation after colonic endoscopic mucosal resection: a new classification and analysis of risk factors.**

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**OBJECTIVES:** Perforation is the most serious complication associated with endoscopic mucosal resection (EMR). We propose a new classification for the appearance and integrity of the muscularis propria (MP) after EMR including various extents of deep mural injury (DMI). Risk factors for these injuries were analysed.

**DESIGN:** Endoscopic images and histological specimens of consecutive patients undergoing EMR of colonic laterally spreading lesions  $\geq 20$  mm at a large Australian tertiary referral endoscopy unit were retrospectively analysed using our new DMI classification system. DMI was graded according to MP injury (I/II intact MP without/with fibrosis, III target sign, IV/V obvious transmural perforation without/with contamination). Histological specimens were examined for included MP and patient outcomes were recorded. All type III-V DMI signs were clipped if possible, types I and II DMI were clipped at the endoscopists' discretion.

**RESULTS:** EMR was performed in 911 lesions (mean size 37 mm) in 802 patients (male sex 51.4%, mean age 67 years). DMI signs were identified in 83 patients (10.3%). Type III-V DMI was identified in 24 patients (3.0%); clipping was successfully performed in all patients. A clinically significant perforation occurred in two patients (0.2%). Only one of the 59 type I/II cases experienced a delayed perforation. 85.5% of patients with DMI were discharged on the same day, all without sequelae. On multivariable analysis, type III-V DMI was associated with transverse colon location (OR 3.55,  $p=0.028$ ), en bloc resection (OR 3.84,  $p=0.005$ ) and high-grade dysplasia or submucosal invasive cancer (OR 2.97,  $p=0.014$ ).

**CONCLUSIONS:** In this retrospective analysis, use of the new classification and management with clips appeared to be a safe approach. Advanced DMI types (III-V) occurred in 3.0% of patients and were associated with identifiable risk factors. Further prospective clinical studies should use this new classification.

*Am J Gastroenterol.* 2016 Aug;111(8):1115-22. doi: 10.1038/ajg.2016.235. Epub 2016 Jun 14.

**Prediction of Clinically Significant Bleeding Following Wide-Field Endoscopic Resection of Large Sessile and Laterally Spreading Colorectal Lesions: A Clinical Risk Score.**

Bahin FF<sup>1,2</sup>, Rasouli KN<sup>1</sup>, Byth K<sup>3,4</sup>, Hourigan LF<sup>5,6</sup>, Singh R<sup>7</sup>, Brown GJ<sup>8,9</sup>, Zanati SA<sup>8,10</sup>, Moss A<sup>10</sup>, Raftopoulos S<sup>11</sup>, Williams SJ<sup>1</sup>, Bourke MJ<sup>1,2</sup>.

**OBJECTIVES:** Clinically significant bleeding (CSPEB) is the most frequent adverse event following wide-field endoscopic mucosal resection (WF-EMR) of large sessile and laterally spreading colorectal lesions (LSL). There is limited knowledge regarding accurate prediction of CSPEB. We aimed to derive a score to predict the risk of CSPEB.

**METHODS:** Data on patient and lesion characteristics and outcomes from WF-EMRs of LSL  $\geq 20$  mm at 8 referral hospitals were analyzed. The cohort was divided at random into equal sized training and test groups. Independent predictors of CSPEB in the training cohort were identified by multiple logistic regression analysis and used to develop a risk score. The performance of this score was assessed in the independent test cohort.

**RESULTS:** Over 80 months to June 2015, 2,128 patients with 2,424 LSL were referred for WF-EMR. Two thousand and twelve patients were eligible for analysis. There were 135 cases of CSPEB (6.7%). In the training cohort of 1,006 patients, the independent predictors of CSPEB were lesion size  $>30$  mm (odds ratio (OR) 2.5), proximal colonic location (OR 2.3), presence of a major comorbidity (OR 1.5), and epinephrine in injection solution (OR 0.57). The derived risk score comprised lesion size  $>30$  mm (2 points), proximal colon (2 points), presence of major comorbidity (1 point), and absence of epinephrine use (1 point). The probabilities of CSPEB for scores of 0, 1, 2, 3, 4, and  $\geq 5$  in the training cohort were 1.5, 2.0, 5.6, 7.8, 9.1, and 17.5% and were 0.9, 6.7, 4.9, 6.2, 9.0, and 15.7% in the test cohort. The probabilities of CSPEB in those with low (score 0-1), medium (score 2-4), and elevated (score 5-6) risk levels were 1.7, 7.1, and 17.5% in the training cohort and 3.4, 6.2, and 15.7% in the test cohort.

**CONCLUSIONS:** Patients at elevated risk of CSPEB can be identified using four readily available variables. This knowledge may improve the management of those undergoing WF-EMR and assist in designing studies evaluating CSPEB.

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**A standardized imaging protocol is accurate in detecting recurrence after EMR.**

Desomer L<sup>1</sup>, Tutticci N<sup>1</sup>, Tate DJ<sup>1</sup>, Williams SJ<sup>1</sup>, McLeod D<sup>2</sup>, Bourke MJ<sup>3</sup>.

**BACKGROUND AND AIMS:** EMR of large laterally spreading lesions (LSL) in the colon is a safe and effective alternative to surgery. Post-EMR scar assessment currently involves taking biopsy specimens of the scar to detect residual or recurrent adenoma (RRA). The accuracy of endoscopic imaging of the post-EMR scar is unknown. We aimed to determine the accuracy of a standardized imaging protocol in post-EMR scar assessment.

**METHODS:** Prospective, single-center data from the Australian Colonic EMR study were analyzed. Consecutive patients undergoing first surveillance colonoscopy (SC1) after EMR of a large LSL were eligible. All scars were sequentially examined with high-definition white light (HD-WL) and narrow-band imaging (NBI) in a standardized fashion and then biopsies were performed. Endoscopic recurrence (recurrence at the post-EMR scar detected by systematic endoscopic assessment) was compared with the histologic findings.

**RESULTS:** One hundred eighty-three post-EMR scars were included. Thirty of 183 (16.4%) were confirmed to have RRA histologically at SC1. Thirty-seven of 183 (20.2%) post-EMR scars demonstrated RRA endoscopically. The sensitivity and specificity of endoscopic RRA detection were 93.3% (95% confidence interval [CI], 77.9%-99.2%) and 94.1% (95% CI, 89.1%-97.3%), respectively. The positive predictive value was 75.7% (95% CI, 58.8%-88.2%) and the negative predictive value was 98.6% (95% CI, 95.1%-99.8%). The diagnostic accuracy was 94.0%. Sensitivity was higher for the combination of HD-WL and NBI as opposed to HD-WL alone (93.3% vs 66.7%). The specificity was high for both HD-WL and HD-WL + NBI (96.1% and 94.1%, respectively). Flat morphology of RRA was better seen with NBI ( $P = .002$ ).

**CONCLUSIONS:** Endoscopic detection of RRA in the post-EMR scar is highly accurate using a standardized imaging protocol with HD-WL and NBI. This allows real-time, accurate detection of recurrence and its concurrent treatment, and raises the possibility that routine biopsy of the post-EMR scar may not be necessary.

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**Randomised controlled trial of transanal endoscopic microsurgery versus endoscopic mucosal resection for large rectal adenomas (TREND Study).**

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**OBJECTIVE:** Non-randomised studies suggest that endoscopic mucosal resection (EMR) is equally effective in removing large rectal adenomas as transanal endoscopic microsurgery (TEM), but EMR might be more cost-effective and safer. This trial compares the clinical outcome and cost-effectiveness of TEM and EMR for large rectal adenomas.

**DESIGN:** Patients with rectal adenomas  $\geq 3$  cm, without malignant features, were randomised (1:1) to EMR or TEM, allowing endoscopic removal of residual adenoma at 3 months. Unexpected malignancies were excluded post-randomisation. Primary outcomes were recurrence within 24 months (aiming to demonstrate non-inferiority of EMR, upper limit 10%) and the number of recurrence-free days alive and out of hospital.

**RESULTS:** Two hundred and four patients were treated in 18 university and community hospitals. Twenty-seven (13%) had unexpected cancer and were excluded from further analysis. Overall recurrence rates were 15% after EMR and 11% after TEM; statistical non-inferiority was not reached. The numbers of recurrence-free days alive and out of hospital were similar (EMR 609 $\pm$ 209, TEM 652 $\pm$ 188,  $p=0.16$ ). Complications occurred in 18% (EMR) versus 26% (TEM) ( $p=0.23$ ), with major complications occurring in 1% (EMR) versus 8% (TEM) ( $p=0.064$ ). Quality-adjusted life years were equal in both groups. EMR was approximately €3000 cheaper and therefore more cost-effective.

**CONCLUSION:** Under the statistical assumptions of this study, non-inferiority of EMR could not be demonstrated. However, EMR may have potential as the primary method of choice due to a tendency of lower complication rates and a better cost-effectiveness ratio. The high rate of unexpected cancers should be dealt with in further studies.

Endoscopy. 2016 Aug;48(8):740-6. doi: 10.1055/s-0042-105436. Epub 2016 Apr 25.

**Prevalence, distribution and risk of sessile serrated adenomas/polyps at a center with a high adenoma detection rate and experienced pathologists.**

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**BACKGROUND AND STUDY AIMS:** Sessile serrated adenomas/polyps (SSA/Ps) are the precursors of 15 %-30% of colorectal cancers (CRC). We aimed to determine the prevalence and distribution of SSA/Ps and to evaluate the association between SSA/Ps and the risk of synchronous advanced neoplasia at a high quality colonoscopy center.

**METHODS:** Data from all colonoscopies performed within one dedicated colonoscopy center between 2011 and 2015 were prospectively retrieved using an automated reporting system. All lesions were assessed by an experienced gastrointestinal pathologist. Multiple logistic regression was used to evaluate influence of age, gender, and colonoscopy indication on prevalence of SSA/Ps, and to assess the association between SSA/Ps and synchronous advanced neoplasia.

**RESULTS:** In total 4251 histologically confirmed polyps were resected in 3364 patients; 399 polyps were SSA/Ps (9.4%). The prevalence of SSA/Ps was 8.2% overall, increasing to 9.0% for individuals older than 50 years. SSA/P detection rate varied between 2.5% and 13.6% among endoscopists. Increased SSA/P prevalence was associated with colonoscopy indications "familial CRC risk" (odds ratio [OR] 1.52, 95% confidence interval [95%CI] 1.05-2.22;  $P=0.03$ ) and "surveillance" (OR 1.73, 95%CI 1.20-2.49;  $P<0.01$ ), when compared with the indication "symptoms." The presence of synchronous advanced neoplasia was associated with SSA/Ps overall (OR 1.71, 95%CI 1.25-2.34;  $P=0.001$ ), as well as with high risk SSA/Ps (defined as  $\geq 10$ mm and/or with dysplasia) (OR 2.70, 95%CI 1.56-4.67;  $P<0.001$ )

**CONCLUSION:** SSA/Ps are more common than previously reported and are associated with the presence of synchronous advanced neoplasia. Endoscopists should be assiduous in identifying SSA/Ps in daily practice and should carefully look for synchronous advanced neoplasia when an SSA/P has been recognized. RESULTS from this study can guide detection standards in general colonoscopy practice adapted to the type of patient that may predominate in an individual department

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**Why attempt en bloc resection of non-pedunculated colorectal adenomas? A systematic review of the prevalence of superficial submucosal invasive cancer after endoscopic submucosal dissection.**

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**OBJECTIVE:** Endoscopic submucosal dissection (ESD) aims to achieve en bloc resection of non-pedunculated colorectal adenomas which might be indicated in cases with superficial submucosal invasive cancers (SMIC), but the procedure is time consuming and complex. The prevalence of such cancers is not known but may determine the clinical necessity for ESD as opposed to the commonly used piecemeal mucosal resection (endoscopic mucosal resection) of colorectal adenomas. The main aim was to assess the prevalence of SMIC SM1 (ie, invasion  $\leq 1000\mu\text{m}$  or less than one-third of the submucosa) on colorectal lesions removed by ESD.

**DESIGN:** A literature review was conducted using electronic databases (up to March 2017) for colorectal ESD series reporting the histology of the dissected lesions.

**RESULTS:** 51 studies with data on 11 260 colorectal dissected lesions were included. Most resected lesions (82.2%; 95% CI 78.8% to 85.3%) were adenomas (low- and high-grade dysplasia, 26.8% and 55.4%, respectively). Overall, 15.7% were submucosal cancers, but only slightly more than half (8.0%; 95% CI 6.1% to 10.3%) had an infiltration depth of  $\leq 1000\mu\text{m}$ , providing a number needed to treat (NNT) to avoid one surgery of 12.5. Estimating an oncologically curative (R0; G1/2; L0/V0) resection rate of 75.3% (95% CI 52.2% to 89.4%) for malignant lesions, the prevalence of curative resection lowered to 6% (95% CI 4.2% to 7.2%) with an NNT of 16.7.

**CONCLUSION:** The low prevalence of SMIC SM1 in lesions selected for ESD as well as the even lower rate of curative resection limits the clinical applicability of endoscopic en bloc resection. This calls for caution over an indiscriminate use of this technique in the resection of colorectal neoplasia.

# KEY ABSTRACTS: UGI

*Endosc Int Open.* 2018 Jan;6(1):E43-E50. doi: 10.1055/s-0043-120829. Epub 2018 Jan 12.

**Acetic acid-guided biopsies in Barrett's surveillance for neoplasia detection versus non-targeted biopsies (Seattle protocol): A feasibility study for a randomized tandem endoscopy trial. The ABBA study.**

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**BACKGROUND AND STUDY AIMS:** Barrett's esophagus is a potentially pre-cancerous condition, affecting 375,000 people in the UK. Patients receive a 2-yearly endoscopy to detect cancerous changes, as early detection and treatment results in better outcomes. Current treatment requires random mapping biopsies along the length of Barrett's, in addition to biopsy of visible abnormalities. As only 13% of pre-cancerous changes appear as visible nodules or abnormalities, areas of dysplasia are often missed. Acetic acid chromoendoscopy (AAC) has been shown to improve detection of pre-cancerous and cancerous tissue in observational studies, but no randomized controlled trials (RCTs) have been performed to date.

**PATIENTS AND METHODS:** A "tandem" endoscopy cross-over design. Participants will be randomized to endoscopy using mapping biopsies or AAC, in which dilute acetic acid is sprayed onto the surface of the esophagus, highlighting tissue through an whitening reaction and enhancing visibility of areas with cellular changes for biopsy. After 4 to 10 weeks, participants will undergo a repeat endoscopy, using the second method. Rates of recruitment and retention will be assessed, in addition to the estimated dysplasia detection rate, effectiveness of the endoscopist training program, and rates of adverse events (AEs). Qualitative interviews will explore participant and endoscopist acceptability of study design and delivery, and the acceptability of switching endoscopic techniques for Barrett's surveillance.

**RESULTS:** Endoscopists' ability to diagnose dysplasia in Barrett's esophagus can be improved. AAC may offer a simple, universally applicable, easily-acquired technique to improve detection, affording patients earlier diagnosis and treatment, reducing endoscopy time and pathology costs. The ABBA study will determine whether a crossover "tandem" endoscopy design is feasible and acceptable to patients and clinicians and gather outcome data to power a definitive trial.

*Gut.* 2017 Sep 28

**International development and validation of a classification system for the identification of Barrett's neoplasia using acetic acid chromoendoscopy: the Portsmouth acetic acid classification (PREDICT).**

Kandiah K<sup>1</sup>, Chedgy FJQ<sup>1</sup>, Subramaniam S<sup>1</sup>, Longcroft-Wheaton G<sup>1</sup>, Bassett P<sup>2</sup>, Repici A<sup>3</sup>, Sharma P<sup>4</sup>, Pech O<sup>5</sup>, Bhandari P<sup>1</sup>.

**BACKGROUND:** Barrett's oesophagus is an established risk factor for developing oesophageal adenocarcinoma. However, Barrett's neoplasia can be subtle and difficult to identify. Acetic acid chromoendoscopy (AAC) is a simple technique that has been demonstrated to highlight neoplastic areas but lesion recognition with AAC remains a challenge, thereby hampering its widespread use.

**OBJECTIVE:** To develop and validate a simple classification system to identify Barrett's neoplasia using AAC.

**DESIGN:** The study was conducted in four phases: phase 1-development of component descriptive criteria; phase 2-development of a classification system; phase 3-validation of the classification system by endoscopists; and phase 4-validation of the classification system by non-endoscopists.

**RESULTS:** Phases 1 and 2 led to the development of a simplified AAC classification system based on two criteria: focal loss of acetowhitening and surface patterns of Barrett's mucosa. In phase 3, the application of PREDICT (Portsmouth acetic acid classification) by endoscopists improved the sensitivity and negative predictive value (NPV) from 79.3% and 80.2% to 98.1% and 97.4%, respectively ( $p < 0.001$ ). In phase 4, the application of PREDICT by non-endoscopists improved the sensitivity and NPV from 69.6% and 75.5% to 95.9% and 96.0%, respectively ( $p < 0.001$ ).

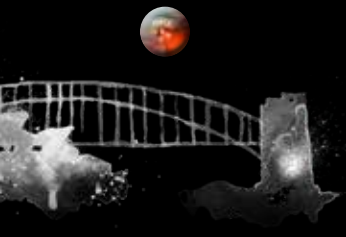
**CONCLUSION:** We developed and validated a classification system known as PREDICT for the diagnosis of Barrett's neoplasia using AAC. The improvement seen in the sensitivity and NPV for detection of Barrett's neoplasia in phase 3 demonstrates the clinical value of PREDICT and the similar improvement seen among non-endoscopists demonstrates the potential for generalisation of PREDICT once proven in real time.

*Gut.* 2018 Feb 24.

**UK guidelines on oesophageal dilatation in clinical practice**

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These are updated guidelines which supersede the original version published in 2004. This work has been endorsed by the Clinical Services and Standards Committee of the British Society of Gastroenterology (BSG) under the auspices of the oesophageal section of the BSG. The original guidelines have undergone extensive revision by the 16 members of the Guideline Development Group with representation from individuals across all relevant disciplines, including the Heartburn Cancer UK charity, a nursing representative and a patient representative. The methodological rigour and transparency of the guideline development processes were appraised using the revised Appraisal of Guidelines for Research and Evaluation (AGREE II) tool. Dilatation of the oesophagus is a relatively high-risk intervention, and is required by an increasing range of disease states. Moreover, there is scarcity of evidence in the literature to guide clinicians on how to safely perform this procedure. These guidelines deal specifically with the dilatation procedure using balloon or bougie devices as a primary treatment strategy for non-malignant narrowing of the oesophagus. The use of stents is outside the remit of this paper; however, for cases of dilatation failure, alternative techniques-including stents-will be listed. The guideline is divided into the following subheadings: (1) patient preparation; (2) the dilatation procedure; (3) aftercare and (4) disease-specific considerations. A systematic literature search was performed. The Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool was used to evaluate the quality of evidence and decide on the strength of recommendations made.



*Gastrointest Endosc.* 2012 Sep;76(3):531-8. doi: 10.1016/j.gie.2012.04.470. Epub 2012 Jun 23.

**Longer inspection time is associated with increased detection of high-grade dysplasia and esophageal adenocarcinoma in Barrett's esophagus.**

Gupta N<sup>1</sup>, Gaddam S, Wani SB, Bansal A, Rastogi A, Sharma P.

**BACKGROUND:** Current guidelines recommend that endoscopic surveillance of Barrett's esophagus (BE) be performed by using a strict biopsy protocol. However, novel methods to improve BE surveillance are still needed.

**OBJECTIVE:** To evaluate the impact of Barrett's inspection time (BIT) on yield of surveillance.

**DESIGN:** Post hoc analysis of data obtained from a clinical trial.

**SETTING:** Five tertiary referral centers.

**PATIENTS:** Patients undergoing BE surveillance.

**INTERVENTIONS:** Coordinators prospectively recorded the time spent inspecting the BE mucosa with a stopwatch.

**MAIN OUTCOME MEASUREMENTS:** Endoscopically suspicious lesions, high-grade dysplasia (HGD)/esophageal adenocarcinoma (EAC).

**RESULTS:** A total of 112 patients underwent endoscopic surveillance by 11 individual endoscopists. Patients with longer BITs were more likely to have an endoscopically suspicious lesion ( $P < .001$ ) and more endoscopically suspicious lesions ( $P = .0001$ ) and receive a diagnosis of HGD/EAC ( $P = .001$ ). There was a direct correlation between the endoscopist's mean BIT per centimeter of BE and the detection of patients with HGD/EAC ( $\rho = .63$ ,  $P = .03$ ). Endoscopists who had an average BIT longer than 1 minute per centimeter of BE detected more patients with endoscopically suspicious lesions (54.2% vs 13.3%,  $P = .04$ ), and there was a trend toward a higher detection rate of HGD/EAC (40.2% vs 6.7%,  $P = .06$ ).

**LIMITATIONS:** Post hoc analysis of an enriched study population and experienced endoscopists at tertiary referral centers.

**CONCLUSIONS:** Longer time spent inspecting the BE segment is associated with the increased detection of HGD/EAC. Taking additional time to perform a thorough examination of the BE mucosa may serve as an easy and widely available method to improve the yield of BE surveillance.

*Gastroenterology*, Vol152, Issue 5

**Peroral Endoscopic Myotomy (Poem) Versus Pneumatic Dilatation in Therapy-Naive Patients with Achalasia: Results of A Randomized Controlled Trial**

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**BACKGROUND:** Case series suggest excellent results of Per-Oral Endoscopic Myotomy (POEM) for achalasia treatment. Data comparing POEM with the gold standard treatment, pneumatic dilatation (PD), are lacking. Aim of this study was to compare the efficacy of POEM versus PD as the initial treatment of therapy-

naïve patients with idiopathic achalasia. Methods: Patients with newly diagnosed achalasia by HRM were randomized to POEM or PD using a 30-35 mm dilatation protocol. Symptoms, including weight loss, dysphagia, retrosternal pain and regurgitation, were assessed with the Eckardt score. Follow-up was planned at 3 months and 1 year after treatment. The primary outcome was therapeutic success (a drop in the Eckardt score to  $\leq 3$  in the absence of severe complications and need of retreatment). Secondary outcomes included integrated relaxation pressure (IRP), barium column height on a timed barium esophagram, complication-rate and the presence of reflux esophagitis.

**RESULTS:** 133 patients were randomly assigned to POEM (67) or PD (66). Three patients randomized to POEM were never treated because of a health insurance issue ( $n=1$ ), complications after prior orthopedic surgery ( $n=1$ ) or sudden emigration before treatment ( $n=1$ ). Baseline characteristics were similar between groups regarding symptoms, age, gender, IRP, barium column height and achalasia subtype. Three months after treatment, success was achieved in 63/64 (98.4%) patients in the POEM group versus 52/66 (78.8%) patients in the PD group,  $p < 0.01$ . After one year, 59/64 (92.2%) patients were still in clinical remission after POEM versus 46/66 (70%) after PD,  $p < 0.01$ . One perforation occurred after PD with a 30-mm balloon, requiring endoscopic overstitching, antibiotics and 13 days of hospitalization. Another patient was admitted for 1 night after PD because of severe chest pain, a perforation was excluded. No severe adverse events occurred related to POEM treatment. POEM and PD patients that were still in clinical remission at one year did not differ in IRP ( $11.2 \pm 0.9$  vs  $14.0 \pm 1.3$  mmHg), barium column height ( $1.9 \pm 0.3$  vs  $1.5 \pm 0.4$  cm) or Eckardt score (1 [0-2] vs 1 [0-2]). Endoscopy at one year follow-up after PPI cessation for  $> 1$  week showed that reflux esophagitis was significantly more present in the patients treated with POEM (40.0% grade A/B, 8.3% grade C/D) than in those treated with PD (13.1% grade A/B, 0% grade C/D),  $p = 0.02$ .

**CONCLUSIONS:** In therapy-naïve idiopathic achalasia patients, POEM results in a significantly higher one-year therapeutic success rate compared to PD. However, development of reflux esophagitis is much more frequently seen after POEM than after PD.

*Endoscopy.* 2016 Jan;48(1):71-4. doi: 10.1055/s-0034-1392603. Epub 2015 Sep 4.

**Efficacy of viscous budesonide slurry for prevention of esophageal stricture formation after complete endoscopic mucosal resection of short-segment Barrett's neoplasia.**

Bahin FF<sup>1</sup>, Jayanna M<sup>1</sup>, Williams SJ<sup>1</sup>, Lee EY<sup>1</sup>, Bourke MJ<sup>1</sup>.

**BACKGROUND AND AIMS:** Complete endoscopic resection (CER) of short-segment Barrett's esophagus with high grade dysplasia (HGD) and early esophageal adenocarcinoma (EEA) is a precise staging tool and achieves durable disease control. The major drawback is development of post-endoscopic resection esophageal stricture (PERES). No effective therapy to prevent PERES has been described. Viscous budesonide slurry (VBS) may have a role in the prevention of PERES by suppressing the post-CER inflammatory process. The study aim was to evaluate the efficacy of VBS for the prevention of PERES.

**METHODS:** Prospective data were collected on patients referred for CER of HGD or EEA. After January 2012, patients routinely received VBS (two 0.5-mg/2-mL budesonide respules mixed with sucralose) twice daily for 6 weeks following each stage of the CER schedule. All patients received high dose proton pump inhibitor therapy for the duration of CER and the following 3 months. Patients had no other intervention to prevent PERES. A validated dysphagia score was used (0-4, no dysphagia to aphagia). Endoscopic dilation was performed for dysphagia. Patients receiving VBS were compared with historical controls. The primary endpoint was the need for dilation.

**RESULTS:** Between January 2008 and January 2015, 104 of 116 eligible patients completed CER. The VBS group (n=29) and non-VBS group (n=75) had similar patient, disease, and procedural characteristics. Dilations were needed in 13.8% vs. 37.3% (P=0.03), with a median of one vs. two procedures (P=0.01), and median dysphagia score during CER of 0 vs. 1 (P=0.02) in the VBS and non-VBS groups, respectively. No VBS-related adverse events were noted.

**CONCLUSION:** In this pilot study VBS significantly reduced PERES and shortened the dilation program after CER.

*Gastrointest Endosc.* 2016 Jan;83(1):68-77. doi: 10.1016/j.gie.2015.04.044. Epub 2015 Jun 18.

**Long-term outcomes of a primary complete endoscopic resection strategy for short-segment Barrett's esophagus with high-grade dysplasia and/or early esophageal adenocarcinoma.**

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**BACKGROUND AND AIMS:** Complete endoscopic resection (CER) of Barrett's esophagus (BE) with high-grade dysplasia (HGD) and early esophageal adenocarcinoma (EEA) is a comprehensive and precise staging tool and may produce a sustained treatment response, preventing metachronous disease. There are limited data on long-term clinical outcomes and the sustainability of dysplasia eradication after CER. We aimed to describe long-term outcomes of a primary CER strategy of BE with HGD/EEA.

**METHODS:** Patients with biopsy-proven HGD and EEA in short-segment BE ( $\leq 3$  cm in circumferential length and  $\leq 5$  cm in maximal length) underwent staged CER by multiband mucosectomy or the cap method. The primary endpoint was remission of HGD or EEA (complete resection of HGD/EEA), dysplasia (complete resection of any dysplasia), and complete resection of intestinal metaplasia.

**RESULTS:** Of 153 patients (126 HGD, 27 EEA; 83.7% male, median age of 66 years) considered suitable for CER, 138 met all inclusion criteria. CER was technically successful in all patients and was established after a median of 2 sessions. Covert synchronous EEA was found in 1 patient. At a mean follow-up of 40.7 months by intention-to-treat analysis, complete remission of HGD/EEA, dysplasia, and intestinal metaplasia was achieved in 98.5%, 89.1%, and 71.0%, respectively. In 47.1% of patients, CER changed the histological grade compared with pretreatment biopsies (28.1% downstaged and 19.0% upstaged). Esophageal dilation was performed in 36.8% in a mean of 2.5 sessions. At the end of follow-up, 96.4% of patients had no or minimal dysphagia and 90.6% of patients found CER an acceptable treatment.

**CONCLUSIONS:** On long-term follow-up, a primary CER strategy was a highly effective, safe, and durable treatment for HGD and EEA. Despite the need for post-CER dilation in one-third of patients, the majority found it an acceptable treatment on long-term follow-up.

*Gastroenterology.* 2018 Feb 24. pii: S0016-5085(18)30216-6. doi: 10.1053/j.gastro.2018.01.068. [Epub ahead of print]

**Endoscopic submucosal dissection: a critical appraisal of its role in Western endoscopy practice.**

Bourke MJ<sup>1</sup>, Neuhaus H<sup>2</sup>, Bergman JJ<sup>3</sup>.

Endoscopic submucosal dissection (ESD) was developed in Japan, early in this century, to provide a minimally invasive yet curative treatment for the large numbers of patients with early gastric cancer identified by the national screening program. Previously the majority of these patients were treated surgically at substantial cost with the significant risk of short and long-term morbidity. En bloc excision of these early cancers, most with a limited risk of nodal metastasis, allowed complete staging of the tumor, stratification of the subsequent therapeutic approach and potential cure. This transformative innovation changed the nature of endoscopic treatment for superficial mucosal neoplasia and ultimately, for the first time, allowed endoscopists to assert that the early cancer had been definitively cured. Subsequently western endoscopists have increasingly embraced the therapeutic possibilities offered by ESD, but with some justifiable scientific caution. Herein we provide an evidence based critical appraisal of the role of ESD in advanced endoscopic tissue resection.

*Gut.* 2017 Nov;66(11):2024-2032. doi: 10.1136/gutjnl-2016-313595. Epub 2017 Aug 24.

**Acute pancreatitis: recent advances through randomised trials.**

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Acute pancreatitis is one of the most common GI conditions requiring acute hospitalisation and has a rising incidence. In recent years, important insights on the management of acute pancreatitis have been obtained through numerous randomised controlled trials. Based on this evidence, the treatment of acute pancreatitis has gradually developed towards a tailored, multidisciplinary effort, with distinctive roles for gastroenterologists, radiologists and surgeons. This review summarises how to diagnose, classify and manage patients with acute pancreatitis, emphasising the evidence obtained through randomised controlled trials.

*Gastrointest Endosc.* 2018 Feb;87(2):348-355. doi: 10.1016/j.gie.2017.07.039. Epub 2017 Jul 27.

**Increased detection of Barrett's esophagus-associated neoplasia using wide-area trans-epithelial sampling: a multicenter, prospective, randomized trial.**

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**BACKGROUND AND AIMS:** Wide-area transepithelial sampling (WATS) with computer-assisted 3-dimensional analysis is a sampling technique that combines abrasive brushing of the Barrett's esophagus (BE) mucosa followed by neural network analysis to highlight abnormal-appearing cells.

**METHODS:** We performed a randomized trial of referred BE patients undergoing surveillance at 16 medical centers. Subjects received either biopsy sampling followed by WATS or WATS followed by biopsy sampling. The primary outcome was rate of detection of high-grade dysplasia/esophageal adenocarcinoma

(HGD/EAC) using WATS in conjunction with biopsy sampling compared with biopsy sampling alone using standard histopathologic criteria. Secondary aims included evaluating neoplasia detection rates based on the procedure order (WATS vs biopsy sampling first), of each procedure separately, and the additional time required for WATS.

**RESULTS:** One hundred sixty patients (mean age, 63.4 years; 76% men; 95% white) completed the trial. The median circumferential and maximal BE extents were 1.0 cm (interquartile range: .0-5.0) and 4.0 cm (interquartile range, 2.0-8.0), respectively. The diagnostic yield for biopsy sampling alone was as follows: HGD/EAC, 7 (4.4%); low-grade dysplasia (LGD), 28 (17.5%); nondysplastic BE (NDBE), 106 (66.25%); and no BE, 19 (11.9%). The addition of WATS to biopsy sampling yielded an additional 23 cases of HGD/EAC (absolute increase, 14.4%; 95% confidence interval, 7.5%-21.2%). Among these 23 patients, 11 were classified by biopsy sampling as NDBE and 12 as LGD/indefinite for dysplasia (IND); 14 received biopsy sampling first and 9 WATS first (not significant) and most (n = 21; 91.7%) had a prior dysplasia history. WATS added an average of 4.5 minutes to the procedure.

**CONCLUSION:** Results of this multicenter, prospective, randomized trial demonstrate that the use of WATS in a referral BE population increases the detection of HGD/EAC. (Clinical trial registration number: NCT03008980.).

*Gastroenterology*. 2017 Dec 19. pii: S0016-5085(17)36713-6. doi: 10.1053/j.gastro.2017.12.009. [Epub ahead of print]

#### **Development and Validation of a Model to Determine Risk of Progression of Barrett's Esophagus to Neoplasia.**

Parasa S<sup>1</sup>, Vennalaganti S<sup>2</sup>, Gaddam S<sup>3</sup>, Vennalaganti P<sup>4</sup>, Young P<sup>5</sup>, Gupta N<sup>6</sup>, Thota P<sup>7</sup>, Cash B<sup>8</sup>, Mathur S<sup>2</sup>, Sampliner R<sup>9</sup>, Moawad F<sup>5</sup>, Lieberman D<sup>10</sup>, Bansal A<sup>4</sup>, Kennedy KF<sup>2</sup>, Vargo J<sup>7</sup>, Falk G<sup>11</sup>, Spaander M<sup>12</sup>, Bruno M<sup>12</sup>, Sharma P<sup>13</sup>.

**BACKGROUND & AIMS:** A system is needed to determine the risk of patients with Barrett's esophagus for progression to high-grade dysplasia (HGD) and esophageal adenocarcinoma (EAC). We developed and validated a model to determine of progression to HGD or EAC in patients with BE, based on demographic data and endoscopic and histologic findings at the time of index endoscopy.

**METHODS:** We performed a longitudinal study of patients with BE at 5 centers in United States and 1 center in Netherlands enrolled in the Barrett's Esophagus Study database from 1985 through 2014. Patients were excluded from the analysis if they had less than 1 year of follow-up, were diagnosed with HGD or EAC within the past year, were missing baseline histologic data, or had no intestinal metaplasia. Seventy percent of the patients were used to derive the model and 30% were used for the validation study. The primary outcome was development of HGD or EAC during the follow-up period (median, 5.9 years). Survival analysis was performed using the Kaplan-Meier method. We assigned a specific number of points to each BE risk factor, and point totals (scores) were used to create categories of low, intermediate, and high risk. We used Cox regression to compute hazard ratios and 95% confidence intervals to determine associations between risk of progression and scores.

**RESULTS:** Of 4584 patients in the database, 2697 were included in our analysis (84.1% men; 87.6% Caucasian; mean age, 55.4 ± 20.1 years; mean body mass index, 27.9 ± 5.5 kg/m<sup>2</sup>; mean length of BE, 3.7 ± 3.2 cm). During the follow-up period, 154 patients (5.7%) developed HGD or EAC, with an annual rate of regression of 0.95%. Male sex, smoking, length of BE, and baseline-confirmed low-grade dysplasia were significantly associated with regression. Scores assigned identified patients with BE that progressed to HGD or EAC with a c-statistic of 0.76 (95% confidence interval, 0.72-0.80; P < .001). The calibration slope was 0.9966 (P = .99), determined from the validation cohort.

**CONCLUSIONS:** We developed a scoring system (regression in Barrett's Esophagus score) based on male sex, smoking, length of BE, and baseline low-grade dysplasia that identified patients with BE at low, intermediate, and high risk for HGD or EAC. This scoring system might be used in management of patients.

*Gastroenterology*. 2017 Apr;152(5):987-992. doi: 10.1053/j.gastro.2016.12.005. Epub 2016 Dec 15.

#### **Low Risk of High-Grade Dysplasia or Esophageal Adenocarcinoma Among Patients With Barrett's Esophagus Less Than 1 cm (Irregular Z Line) Within 5 Years of Index Endoscopy.**

Thota PN<sup>1</sup>, Vennalaganti P<sup>2</sup>, Vennalaganti S<sup>3</sup>, Young P<sup>4</sup>, Gaddam S<sup>5</sup>, Gupta N<sup>6</sup>, Lieberman D<sup>7</sup>, Sampliner R<sup>8</sup>, Falk GW<sup>9</sup>, Mathur S<sup>3</sup>, Kennedy K<sup>3</sup>, Cash BD<sup>10</sup>, Moawad F<sup>4</sup>, Bansal A<sup>3</sup>, Spaander MC<sup>11</sup>, Bruno MJ<sup>11</sup>, Vargo J<sup>12</sup>, Sharma P<sup>13</sup>.

**BACKGROUND & AIMS:** Many patients with a < 1 cm segment of columnar metaplasia in the distal esophagus, also called an irregular Z line, are encountered. These patients, often referred to as patients with Barrett's esophagus (BE), are enrolled in surveillance programs. However, little is known about their risk of high-grade dysplasia (HGD) or esophageal adenocarcinoma (EAC). We aimed to determine the incidence of HGD and EAC in patients with irregular Z line with intestinal metaplasia.

**METHODS:** We performed a prospective, multicenter cohort study of patients who underwent endoscopic examination for BE at tertiary care referral centers in the United States and Europe. We analyzed data from 1791 patients (mean age, 56 ± 17 years) found to have non-dysplastic BE at the index endoscopy and after 1 year or more of follow-up. Patients were followed for a median of 5.9 years (interquartile range, 3.1-8.3 years). We calculated rates of progression to HGD or EAC between groups of patients with irregular Z line (n = 167) and those with BE of ≥ 1 cm (n = 1624).

**RESULTS:** A higher proportion of patients in the irregular Z-line group were female (26.3%) than in the BE group (14.8% female BE) (P < .001). A lower proportion of patients in the irregular Z-line group were smokers (33.5%) than in the BE group (52.6% smokers). None of the patients with irregular Z line developed HGD or EAC during a median follow-up period of 4.8 years (interquartile range, 3.2-8.3 years). All 71 incident cases of HGD or EAC developed in patients with BE of ≥ 1 cm in length. On multivariate analysis, patients with irregular Z line and patients with BE of ≥ 1 cm did not differ significantly in age, race, or duration of follow-up.

**CONCLUSIONS:** In a prospective, multicenter cohort study, we found that patients with irregular Z line do not develop HGD or esophageal cancer within 5 years after index endoscopy.



*J Gastroenterol.* 2017 Apr;52(4):466-475. doi: 10.1007/s00535-016-1239-4. Epub 2016 Jul 22.

***Image assessment of Barrett's esophagus using the simplified narrow band imaging classification.***

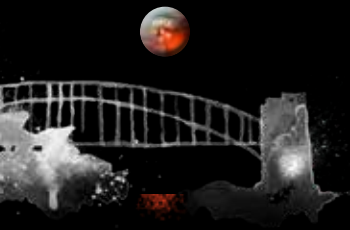
Kato M<sup>1</sup>, Goda K<sup>2</sup>, Shimizu Y<sup>3</sup>, Dobashi A<sup>4</sup>, Takahashi M<sup>3</sup>, Ikegami M<sup>5</sup>, Shimoda T<sup>6</sup>, Kato M<sup>7</sup>, Sharma P<sup>8</sup>.

**BACKGROUND:** A simplified narrow band imaging (NBI) classification has been proposed with the objective of integrating multiple classifications of NBI surface patterns in Barrett's esophagus (BE). Little is known about the impact of the simplified NBI classification on the diagnosis of BE when using high-definition magnification endoscopy with NBI (HM-NBI). This study aimed to evaluate (a) the reproducibility of NBI surface patterns and predicted histology and (b) the diagnostic accuracy of interpreting HM-NBI images by using the simplified NBI classification.

**METHODS:** Two hundred and forty-eight HM-NBI images from macroscopically normal areas in patients with BE were retrieved from endoscopy databases and randomized for review by four endoscopists (two experts, two non-experts). We evaluated inter- and intra-observer agreement of the interpretation of NBI surface patterns and the predicted histology (dysplasia vs. non-dysplasia), as calculated by using  $\kappa$  statistics, and diagnostic values of the prediction.

**RESULTS:** The overall inter-observer agreements were substantial for mucosal pattern ( $\kappa = 0.73$ ) and vascular pattern ( $\kappa = 0.71$ ), and almost perfect for predicting dysplastic histology ( $\kappa = 0.80$ ). The overall intra-observer agreements were almost perfect for mucosal ( $\kappa = 0.84$ ) and vascular patterns ( $\kappa = 0.86$ ), and predicting dysplastic histology ( $\kappa = 0.89$ ). The mean accuracy in predicting dysplastic histology for all reviewers was 95 % (experts: 96.8 %, non-experts: 93.1 %).

**CONCLUSIONS:** The simplified NBI classification has the potential to provide high diagnostic reproducibility and accuracy when using HM-NBI.



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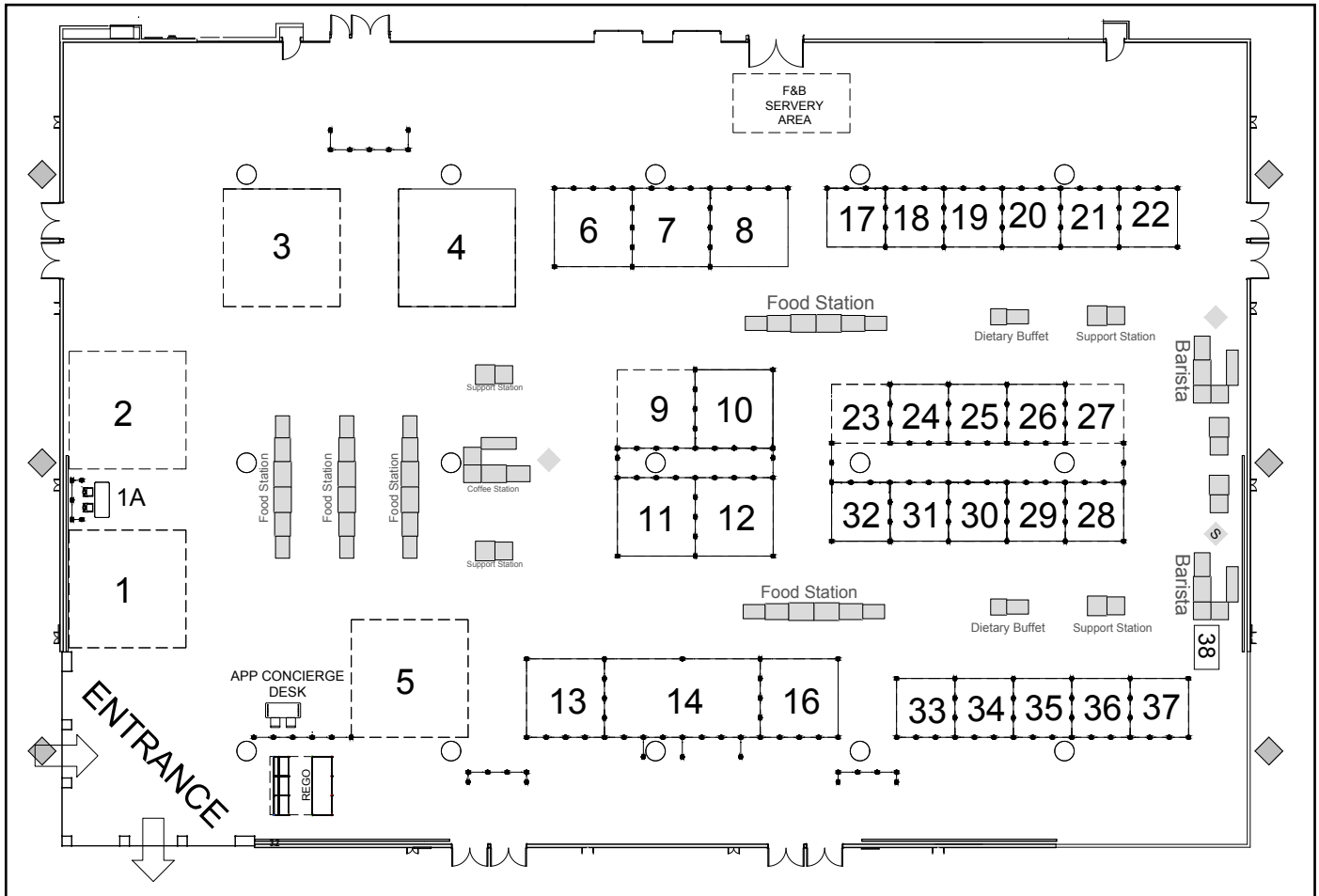
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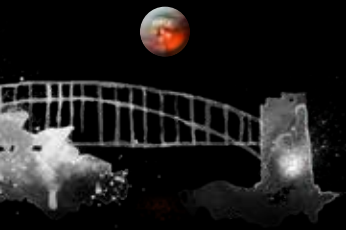
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# APPENDIX - ESGE GUIDELINE

## Colorectal polypectomy and endoscopic mucosal resection (EMR): European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline



### Authors

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### Bibliography

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Appendix e1, e2

Online content viewable at: <https://www.thieme-connect.com/DOI/DOI?10.1055/s-0043-102569>

### MAIN RECOMMENDATIONS

- 1 ESGE recommends cold snare polypectomy (CSP) as the preferred technique for removal of diminutive polyps (size  $\leq 5$  mm). This technique has high rates of complete resection, adequate tissue sampling for histology, and low complication rates. (High quality evidence, strong recommendation.)
- 2 ESGE suggests CSP for sessile polyps 6–9 mm in size because of its superior safety profile, although evidence comparing efficacy with hot snare polypectomy (HSP) is lacking. (Moderate quality evidence, weak recommendation.)
- 3 ESGE suggests HSP (with or without submucosal injection) for removal of sessile polyps 10–19 mm in size. In most cases deep thermal injury is a potential risk and thus submucosal injection prior to HSP should be considered. (Low quality evidence, strong recommendation.)
- 4 ESGE recommends HSP for pedunculated polyps. To prevent bleeding in pedunculated colorectal polyps with head  $\geq 20$  mm or a stalk  $\geq 10$  mm in diameter, ESGE recommends pretreatment of the stalk with injection of dilute adrenaline and/or mechanical hemostasis. (Moderate quality evidence, strong recommendation.)

5 ESGE recommends that the goals of endoscopic mucosal resection (EMR) are to achieve a completely snare-resected lesion in the safest minimum number of pieces, with adequate margins and without need for adjunctive ablative techniques. (Low quality evidence; strong recommendation.)

6 ESGE recommends careful lesion assessment prior to EMR to identify features suggestive of poor outcome. Features associated with incomplete resection or recurrence include lesion size > 40 mm, ileocecal valve location, prior failed attempts at resection,

and size, morphology, site, and access (SMSA) level 4. (Moderate quality evidence; strong recommendation.)

7 For intraprocedural bleeding, ESGE recommends endoscopic coagulation (snare-tip soft coagulation or coagulating forceps) or mechanical therapy, with or without the combined use of dilute adrenaline injection. (Low quality evidence, strong recommendation.)

An algorithm of polypectomy recommendations according to shape and size of polyps is given (► Fig. 1).

**This Guideline is an official statement of the European Society of Gastrointestinal Endoscopy (ESGE). The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system was adopted to define the strength of recommendations and the quality of evidence.**

## Introduction

The endoscopic removal of colorectal polyps reduces the incidence and mortality of colorectal cancer (CRC) and is considered an essential skill for all endoscopists who perform colonoscopy [1–3]. Various polypectomy techniques and devices are available, their use often varying based on local preferences and availability [4–6]. This evidence-based Guideline was commissioned by the European Society of Gastrointestinal Endoscopy (ESGE). It addresses all major issues concerning the practical use of polypectomy and endoscopic mucosal resection (EMR), to inform and underpin this fundamental technique in colonoscopy and in CRC prevention.

This Guideline does not address management of anticoagulants and other medications in the periprocedural setting, nor post-polypectomy surveillance or quality measurements, as these are addressed in separate Guidelines [7–9].

## Methods

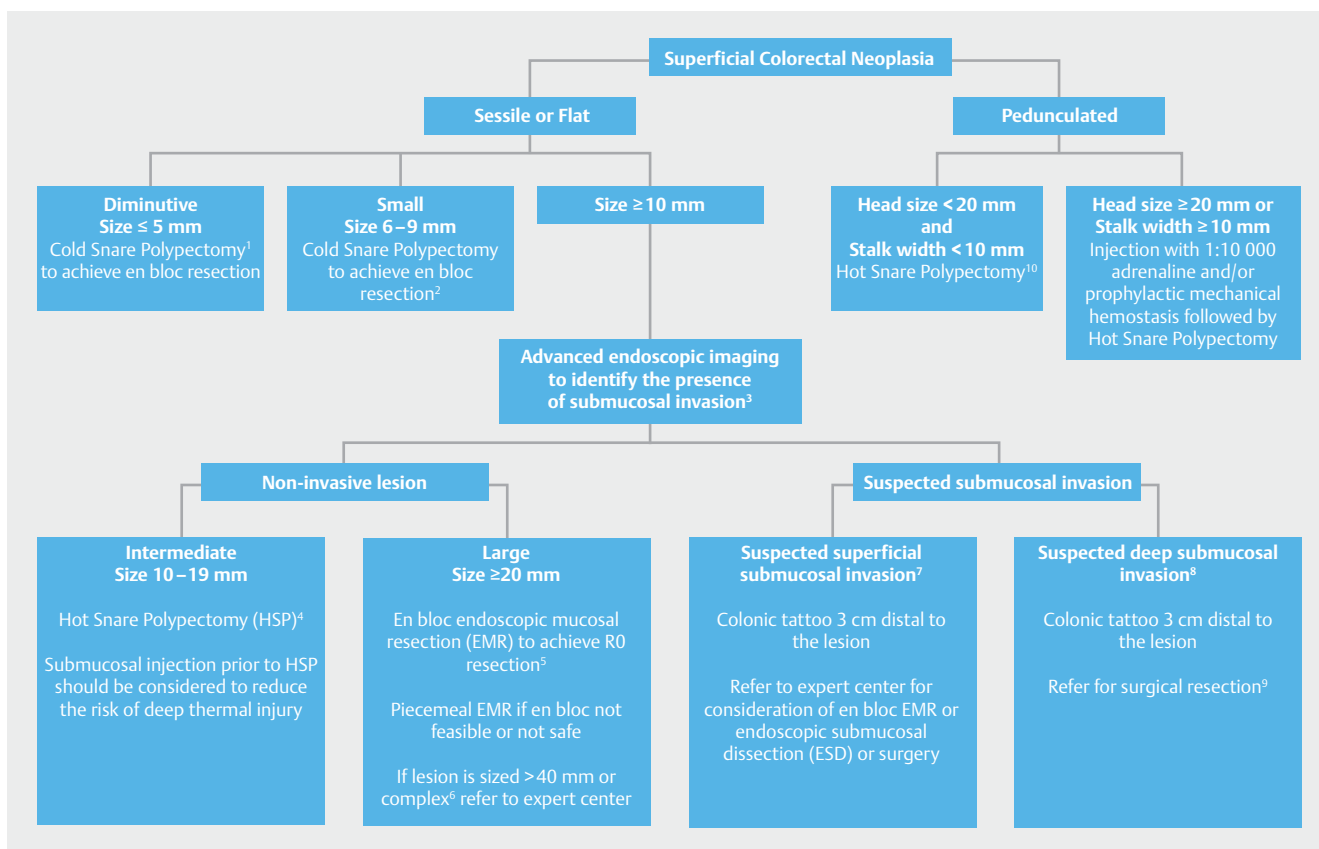
The European Society of Gastrointestinal Endoscopy (ESGE) commissioned this Guideline and appointed a Guideline leader (M.F.) who invited the listed authors to participate in the project development. The key questions were prepared by the coordinating team (M.F., A.M., M.J.B., C.H.) and then approved by the other members. The coordinating team formed task force subgroups, each with its own leader, and divided the key topics (polyp classification, polypectomy for polyps sized <20 mm, EMR for polyps ≥20 mm, technical considerations, adverse events, histopathology) among these task forces (see **Appendix 1**, available online in Supplementary material).

Each task force performed a systematic literature search to prepare evidence-based and well-balanced statements on their assigned key questions. Searches were performed in Medline. Articles were first selected by title; their relevance was then confirmed by review of the corresponding manuscripts, and articles with content that was considered irrelevant were excluded. Evidence tables were generated for each key question, summarizing the evidence of the available studies (see **Appendix 2**, available online in Supplementary material). For important out-

### ABBREVIATIONS

|               |   |
|---------------|---|
| <b>ASGE</b>   | American Society for Gastrointestinal Endoscopy   |
| <b>CBF</b>    | cold biopsy forceps   |
| <b>CI</b>     | confidence interval   |
| <b>CRC</b>    | colorectal cancer   |
| <b>CSP</b>    | cold snare polypectomy  |
| <b>EMR</b>    | endoscopic mucosal resection  |
| <b>ESD</b>    | endoscopic submucosal dissection  |
| <b>ESGE</b>   | European Society of Gastrointestinal Endoscopy  |
| <b>FICE</b>   | flexible spectral imaging color enhancement (also Fuji Intelligent Chromo Endoscopy)                |
| <b>GRADE</b>  | Grading of Recommendations Assessment, Development and Evaluation                                   |
| <b>HBF</b>    | hot biopsy forceps  |
| <b>HD-WLE</b> | high definition white light endoscopy   |
| <b>HSP</b>    | hot snare polypectomy   |
| <b>IPB</b>    | intraprocedural bleeding  |
| <b>I-SCAN</b> | i-SCAN digital contrast (Pentax; image processing providing digital image-enhanced endoscopy [IEE]) |
| <b>LSL</b>    | laterally spreading lesion  |
| <b>LST</b>    | laterally spreading tumor   |
| <b>MP</b>     | muscularis propria  |
| <b>NBI</b>    | narrow-band imaging   |
| <b>NICE</b>   | NBI International Colorectal Endoscopic Classification  |
| <b>NPV</b>    | negative predictive value   |
| <b>PEC</b>    | prophylactic endoscopic coagulation   |
| <b>PPB</b>    | post polypectomy bleeding   |
| <b>PPV</b>    | positive predictive value   |
| <b>RCT</b>    | randomized controlled trial   |
| <b>RR</b>     | relative risk   |
| <b>SMI</b>    | submucosal invasion   |
| <b>SMSA</b>   | size, morphology, site, and access  |
| <b>STSC</b>   | snare-tip soft coagulation  |
| <b>TEMS</b>   | transanal endoscopic microsurgery   |
| <b>WHO</b>    | World Health Organization   |
| <b>WLE</b>    | white light endoscopy   |

comes, articles were individually assessed by the level of evidence and strength of recommendation according to the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) system [10, 11].



► **Fig. 1** Recommended resection techniques for colorectal polyps according to shape and size. <sup>1</sup> Cold biopsy forceps could be considered as a second-line option, but should only be used for polyps of size  $\leq 3$  mm where cold snare polypectomy (CSP) is technically difficult. <sup>2</sup> When en bloc resection is not achieved, oligo-piecemeal excision is acceptable; however complete retrieval of specimens for histology is necessary. <sup>3</sup> Standard chromoendoscopy if advanced endoscopic imaging is not available. <sup>4</sup> Piecemeal cold snare resection may be considered in cases where risk of deep thermal injury is high or unable to be tolerated, but further evidence of efficacy is required. <sup>5</sup> This may be feasible for lesions of size  $\leq 25$  mm and especially those in the left colon or rectum. <sup>6</sup> Difficult location or poor access (e.g. ileocecal valve, periappendiceal, or anorectal junction); prior failed attempts at resection; non-lifting with submucosal injection; size, morphology, site, and access (SMSA) level 4. <sup>7</sup> Kudo Vi, Sano IIIa. <sup>8</sup> Kudo Vn, Sano IIIb, narrow-band imaging (NBI) International Colorectal Endoscopic (NICE) classification 3, polyp morphology including ulceration, excavation, deep demarcated depression. <sup>9</sup> Surgical resection is required because both the lesion and the local draining lymph nodes require excision. <sup>10</sup> When bleeding risk is high because of antiplatelet or anticoagulant medication or coagulopathy, an individualized approach is justified and prophylactic mechanical hemostasis should be considered.

Each task force proposed statements on their assigned key questions which were discussed and voted on during a guideline meeting in Barcelona in October 2015. In July 2016, a draft prepared by the leaders and coordinating team was sent to all group members. The manuscript was also reviewed by two members of the ESGE Governing Board and sent for further comments to the National Societies and Individual Members. After agreement on a final version, the manuscript was submitted to the journal *Endoscopy* for publication. All authors agreed on the final revised manuscript.

This Guideline was issued in 2017 and will be considered for review and update in 2022 or sooner if new and relevant evidence becomes available. Any updates to the Guideline in the interim will be noted on the ESGE website: <http://www.esge.com/esge-guidelines.html>.

## 1. Definition, classification, removal, and retrieval of polyps

### RECOMMENDATION

ESGE recommends that gross morphology of polyps should be described using the Paris classification system and sized in millimeters. (Moderate quality evidence; strong recommendation.)

### RECOMMENDATION

ESGE recommends that for flat and sessile (Paris II and Is) polyps  $\geq 10$  mm, termed laterally spreading lesions (LSLs) or laterally spreading tumors (LSTs), surface morphology should be also described as granular or nongranular. (Moderate quality evidence; strong recommendation.)

The Paris classification of superficial neoplastic lesions (**► Table 1**) [12] updated in 2005 [13], has been adapted from the Kudo classification of early colorectal cancers published in 1993 [14]. The Paris classification allows prediction of advanced histology and invasive cancer (type IIc lesions) [15–17] and it is associated with completeness of endoscopic resection [18]. However, its validity has been questioned as, in a recent study, the interobserver agreement between 7 Western expert endoscopists was only moderate ( $\kappa$  0.42) and pairwise agreement, before and after training, was also low at 60% [19].

LSTs, described in the original Kudo classification, were not included in the Paris classification. LSTs have been further subdivided into granular (homogeneous or nodular-mixed) and nongranular (elevated or pseudodepressed) types because of substantial differences in the risk of invasive cancer [13, 20, 21].

The size of both polypoid and nonpolypoid lesions has been shown to be an additional predictive factor for the risk of invasive cancer, allowing a more accurate stratification of the risk according to morphology and size [12, 15–17].

### RECOMMENDATION

ESGE recommends that all polyps be resected except for diminutive ( $\leq 5$  mm) rectal and rectosigmoid polyps that are predicted with high confidence to be hyperplastic. (High quality evidence; strong recommendation.)

### RECOMMENDATION

ESGE recommends retrieval of all resected polyps for histopathological examination. In expert centers, where optical diagnosis may be made with a high degree of confidence, a “resect and discard” strategy may be considered for diminutive polyps. (Moderate quality evidence; strong recommendation.)

Diminutive colonic polyps present a very low risk of cancer (0–0.6%) that justifies a “resect and discard” strategy. For hyperplastic polyps located in the rectosigmoid, a “diagnose and leave behind” strategy is appropriate because these harbor an even lower risk of cancer [22]. To guide decisions for diminutive colonic polyps, their histopathology should be assessed during endoscopy in real time with a high accuracy, and the American Society for Gastrointestinal Endoscopy (ASGE) has proposed that, in order to:

1. “Diagnose and leave behind” rectosigmoid diminutive hyperplastic polyps, the technology used should provide

► **Table 1** The original Paris classification of superficial neoplastic lesions [12–14].

|  |     |
|--|-----|
| Pedunculated   | Ip  |
| Semipedunculated   | Isp |
| Sessile, higher than height of closed forceps (2.5 mm)           | Is  |
| Slightly elevated, below height of closed forceps (2.5 mm)       | Ila |
| Completely flat lesion, does not protrude above mucosal surface  | Ilb |
| Slightly depressed, lower than mucosa but depth less than 1.2 mm | Ilc |
| Excavated/ulcerated, deep ulcer below mucosa below 1.2 mm        | III |

a negative predictive value (NPV)  $\geq 90\%$  for adenomatous histopathology;

2. “Resect and discard” diminutive polyps, the technology, when used with high confidence and in combination with the histopathological assessment of polyps  $> 5$  mm, should provide a  $\geq 90\%$  agreement in assignment of post-polypectomy surveillance intervals compared to decisions based on histopathological assessment of all polyps [23].

A meta-analysis showed that the NPVs of narrow band imaging (NBI), flexible spectral imaging color enhancement (FICE; also Fuji Intelligent Chromo Endoscopy) and i-SCAN digital contrast (I-SCAN) for adenomatous polyp histology of small and diminutive colorectal polyps were, for all endoscopists, 91%, 84%, and 80%, respectively; in expert and novice hands, respectively, the NPVs were 93% and 87% (NBI), 96% and 72% (FICE), and 80% and 80% (I-SCAN) [24–26]. Therefore, NBI complies with the abovementioned requirements for both strategies. The important caveats with regard to real-time optical diagnosis concern the endoscopist’s expertise in optical biopsy and degree of confidence.

## 2. Resection of polyps $< 20$ mm in size

### 2.1 Resection of diminutive polyps ( $\leq 5$ mm)

### RECOMMENDATION

ESGE recommends cold snare polypectomy (CSP) as the preferred technique for removal of diminutive polyps (size  $\leq 5$  mm). This technique has high rates of complete resection, adequate tissue sampling for histology, and low complication rates. (High quality evidence; strong recommendation.)

Studies show that cold snare polypectomy (CSP) is superior to cold biopsy forceps (CBF) for completeness of diminutive polyp resection. In a randomized controlled trial (RCT) that included 117 diminutive polyps sized  $< 5$  mm in 52 consecutive patients, the rate of histologic eradication was significantly higher in the

CSP group than in the CBF group (93% vs. 76%,  $P=0.009$ ). Furthermore, the time taken for polypectomy was significantly shorter in the CSP group (14 s vs. 22 s,  $P<0.001$ ) [27]. In another RCT that included 145 polyps sized  $<7$  mm, the complete resection rate for adenomatous polyps was significantly higher in the CSP group compared with the CBF group (96.6% vs. 82.6%;  $P=0.01$ ) [28]. CSP also avoids the adverse events associated with thermal electrocautery in hot biopsy forceps (HBF) and hot snare techniques.

#### RECOMMENDATION

ESGE recommends against the use of cold biopsy forceps (CBF) excision because of high rates of incomplete resection. In the case of a polyp sized 1–3 mm where cold snare polypectomy is technically difficult or not possible, cold biopsy forceps may be used. (Moderate quality evidence; strong recommendation.)

In a prospective study of 52 patients with diminutive polyps that were removed by CBF until no residual polyp tissue was visible, the polypectomy sites were then excised by EMR. The EMR histology showed that only 39% of the polyps were completely resected using CBF [29]. However, higher complete resection rates have been demonstrated in another study where CBF excision of 86 diminutive polyps was performed with chromoendoscopy until no visible polyp was observed. Each polyp base was then resected using EMR. The complete resection rate was 92% for all diminutive adenomas (95% confidence interval [95%CI] 85.8–98.8%) and 100% for 1–3-mm adenomas (95%CI 81.5–100%) [30]. Furthermore, in a retrospective study that evaluated the results from 102 jumbo biopsy forceps polypectomy and 161 standard biopsy forceps polypectomy, one-bite CBF polypectomy using either standard or jumbo forceps achieved complete resection for diminutive polyps  $<3$  mm, though more bites were required with standard forceps for polyps sized 4–5 mm [31].

#### RECOMMENDATION

ESGE recommends against the use of hot biopsy forceps (HBF) because of high rates of incomplete resection, inadequate tissue sampling for histopathological examination, and unacceptably high risks of adverse events in comparison with snare excision (deep thermal injury and delayed bleeding). (High quality evidence; strong recommendation.)

In a prospective study involving 62 diminutive rectosigmoid polyps removed via HBF, 17% had persisting viable polyp remnants as shown during follow-up flexible sigmoidoscopy 1–2 weeks later [32]. Another prospective study involving patients with diminutive rectal adenomas found that the rate of remnant adenoma tissue after HBF polypectomy was 10.8% [33]. The overall diagnostic quality of specimens removed by HBF

was shown to be inferior to those removed by jumbo CBF in a prospective study (80% vs. 96%;  $P<0.001$ ); furthermore, 92% of HBF specimens in this study demonstrated cautery damage or crush artifact [34]. In a retrospective study of 1964 diminutive polyps in 753 consecutive colonoscopies, 1525 were removed by HBF, 436 were removed by CBF, and 3 were removed by snare. The risk of significant hemorrhage with HBF was 0.4% overall, with the risk highest in the right colon (1.3% in cecum and 1.0% in the ascending colon) [35]. High rates (32%–44%) of transmural colonic injury with HBF were demonstrated in animal studies [36, 37].

## 2.2 Resection of small polyps (6–9 mm)

#### RECOMMENDATION

ESGE recommends snare polypectomy for sessile polyps 6–9 mm in size. ESGE recommends against the use of biopsy forceps for resection of such polyps because of high rates of incomplete resection. (High quality evidence; strong recommendation.)

In an RCT of CSP versus CBF, the rate of residual neoplastic tissue found after polypectomy for polyps sized 5–7 mm was significantly lower in the CSP group compared with the CBF polypectomy group (6.2% vs 29.7%;  $P=0.13$ ) [28]. A similarly low rate of residual neoplastic tissue (6.8%) was found in a prospective study that evaluated hot snare polypectomy (HSP) for polyps sized 5–9 mm [38].

#### RECOMMENDATION

ESGE suggests CSP for sessile polyps 6–9 mm in size because of its superior safety profile, although evidence comparing efficacy with HSP is lacking. (Moderate quality evidence; weak recommendation.)

An RCT of HSP vs. CSP for polyps up to 10 mm in size in 70 patients receiving anticoagulation treatment found that there were significantly higher rates of intraprocedural bleeding (23% vs. 5.7%,  $P=0.042$ ) and post-procedural bleeding requiring hemostasis (14% vs. 0%;  $P=0.027$ ) in the HSP group compared to the CSP group. Complete polyp retrieval rates were equivalent (94% vs. 93%) [39]. Another RCT found higher rates of intraprocedural bleeding for CSP vs. HSP (9.1% vs. 1.0%;  $P<0.001$ ) for 3–8-mm polyps, although bleeding resolved spontaneously in all cases and therefore was of little clinical significance [40]. In another RCT involving 80 patients with polyps sized  $\leq 8$  mm, no bleeding requiring hemostasis occurred in the HSP or in the CSP group. However, post-procedure abdominal symptoms were more common in the HSP group (20.0% vs. 2.5%;  $P=0.029$ ), and procedure time was significantly shorter with CSP [41]. The advantages of CSP over HSP therefore include lower rates of delayed bleeding, lower frequency of post-polypectomy syndrome, and shorter procedure duration.

### 2.3 Polypectomy of sessile polyps (10–19 mm)

#### RECOMMENDATION

ESGE suggests hot snare polypectomy (HSP) (with or without submucosal injection) for removal of sessile polyps 10–19 mm in size. In most cases deep thermal injury is a potential risk and thus submucosal injection prior to HSP should be considered. (Low quality evidence; strong recommendation.)

HSP is the predominant technique for removal of polyps of size 10–19 mm, though the data comparing HSP to other techniques in this setting are limited. In a retrospective study of 941 polyps, of the 248 polyps sized >5 mm that were removed endoscopically, 191 (77%) were resected using HSP [42]. For polyps sized 10–19 mm, CSP usually cannot achieve “en bloc” resection and the use of biopsy forceps is ineffective for achieving complete resection as well as time-consuming.

In contrast, en bloc resection via HSP is possible, particularly if submucosal injection is used. Submucosal injection can also enhance the safety of HSP for polyps of this size, by reducing the risk of deep thermal injury. The choice of the substance used for submucosal injection used may influence outcomes of HSP for polyps of this size. For example, 196 patients with polyps sized <20 mm were randomized to undergo EMR following submucosal injection with either 0.13% hyaluronic acid or normal saline. Complete resection was achieved in 79.5% of polyps in the 0.13% hyaluronic acid group and in 65.6% of polyps in the normal saline group ( $P<0.05$ ).

The Complete Adenoma Resection (“CARE”) study showed that the rates of incomplete resection with HSP are significantly higher for polyps sized 10–20 mm compared to smaller polyps (17.3% vs. 6.8%;  $P=0.003$ ) [38]. Therefore, colonoscopists must take time to ensure completeness of resection.

#### RECOMMENDATION

In certain situations, there may be a role for piecemeal cold snare polypectomy to reduce the risk of deep mural injury, but further studies are needed. (Low quality evidence; weak recommendation.)

In a retrospective study that evaluated piecemeal CSP outcomes in sessile polyps of size >10 mm, 30 sessile polyps >10 mm in size were analyzed, of which 15 were between 10 and 19 mm. All polyps were completely retrieved without any adverse events such as delayed bleeding, post-polypectomy syndrome, or perforation [43]. Of 27 patients who underwent follow-up colonoscopy within 6 months, 80% did not have residual polypoid tissue at the resection site.

A prospective Argentinian cohort study involving 124 patients, evaluated the safety of CSP where a piecemeal technique was used as required. Of 171 sessile polyps, 43 were sized between 10 and 19 mm. Although there were no subgroup ana-

lyses of 10–19-mm lesions, no immediate or delayed adverse events such as bleeding or perforation were observed in the overall cohort [44].

Piecemeal CSP has therefore been shown to be safe; however subsequent histological assessment may be less accurate and further prospective studies are required to determine the clinical relevance of this technique and its efficacy for completeness of resection for sessile polyps sized 10–19 mm.

### 2.4 Polypectomy of pedunculated lesions

#### RECOMMENDATION

ESGE recommends HSP for pedunculated polyps. To prevent bleeding, in pedunculated colorectal polyps with head  $\geq 20$  mm or a stalk  $\geq 10$  mm in diameter, ESGE recommends pretreatment of the stalk with injection of dilute adrenaline and/or mechanical hemostasis. (Moderate quality evidence; strong recommendation.)

Most pedunculated lesions are usually easily removed completely by HSP. The main adverse event is post-polypectomy bleeding (PPB). Large pedunculated polyps have an increased risk of PPB because of the presence of a large blood vessel within the stalk [45]. Studies have shown that polyp-related risk factors for PPB include polyp size >10 mm, stalk diameter >5 mm, location in the right colon, and the presence of malignancy [45–48].

Mechanical hemostasis with endoloops or clips and pharmacological intervention with injection of dilute adrenaline are effective in reducing PPB in pedunculated polyps of size >10 mm, with the greatest benefit observed in polyps >20 mm [49,50]. RCTs showed that pretreatment by infiltration of the polyp stalk with 1:10 000 adrenaline significantly reduces PPB compared with no intervention ( $P<0.05$ ) [49,51]. However, in another RCT of adrenaline vs. normal saline injection before polypectomy of polyps >10 mm in size, the lower rates of bleeding found with adrenaline did not reach statistical significance [52]. Mechanical prophylaxis such as the use of endoloops or endoclips may be superior to adrenaline injections in achieving hemostasis. Two RCTs involving polyps >20 mm in size, showed that the use of mechanical devices for pretreatment of the stalk, alone or in combination with adrenaline injection, significantly decreased PPB compared with adrenaline injection alone [53,54].

## 2.5 Which polyps should be removed by an expert endoscopist in a referral or tertiary center?

### RECOMMENDATION

Large ( $\geq 20$  mm) sessile and laterally spreading or complex polyps, should be removed by an appropriately trained and experienced endoscopist, in an appropriately resourced endoscopy center. (Moderate quality evidence, strong recommendation.)

Large laterally spreading and sessile colorectal lesions  $\geq 20$  mm in size (Paris classification 0-IIa, 0-Is, 0-Isp), or lesions located in difficult sites such as the ileocecal valve, appendiceal orifice, and anorectal junction, or located behind haustral folds, should be referred to an expert endoscopist in a tertiary center for removal [4, 55–57]. In the largest cohort of advanced lesions involving the ileocecal valve (53 patients, median lesion size 35 mm), among 47 patients who underwent EMR, complete adenoma clearance was achieved endoscopically in 94% and ultimately surgery was avoided in 81% [56]. Although surgery was previously the preferred technique for these “defiant” lesions, endoscopic resection techniques such as EMR offer a safe and effective alternative [58–61]. Recent large EMR cohort studies have demonstrated technical success rates of  $>90\%$  for large laterally spreading and sessile colorectal lesions [55, 57, 60].

There are few studies that compare differences in outcomes between expert and non-expert colonoscopists. In a retrospective cohort study that compared the outcomes of endoscopic resections of 130 large sessile polyps by 2 specialist and 2 non-specialist colonoscopists, specialist colonoscopists had a higher success rate (75% vs. 40%,  $P=0.01$ ) [62]. However, a clear definition of an expert endoscopist is not evident in the literature. Similarly, there is no clear definition of what constitutes an appropriately resourced endoscopy center. However, since EMR for large or complex polyps carries substantially greater risk than standard diagnostic colonoscopy, to ensure that patient safety is optimized, the health facility should have the capability to address the range of possible adverse events such as perforation or bleeding. These would include radiology with computed tomography scanning, surgical support, and capability for blood product administration.

## 2.6 Polyps requiring other (non-snare) techniques, e.g. endoscopic submucosal dissection (ESD) or surgery

### RECOMMENDATION

The majority of colonic and rectal lesions can be effectively removed in a curative way by standard polypectomy and/or by EMR. (Moderate quality evidence; strong recommendation.)

Many studies have shown that snare polypectomy or EMR using submucosal injection followed by en bloc or piecemeal snare resection are suitable for removing the majority of nonmalignant colonic polyps [4, 61, 63, 64]. Piecemeal EMR for large polyps is associated with moderate rates of recurrent adenoma (16% in a large prospective study); however, these recurrent lesions are usually diminutive in size and can mostly be easily removed at surveillance colonoscopy, with an ultimately high success rate of 93% [4, 60]. The EMR approach is safe, efficient, and cost-effective compared to surgical or other more complex endoscopic alternatives [57, 65–69].

### RECOMMENDATION

En bloc resection techniques such as en bloc EMR, ESD, or surgery should be the techniques of choice in cases of suspected superficial invasive carcinoma. (Moderate quality evidence; strong recommendation.)

In cases of suspected superficial invasive carcinoma, endoscopic treatment may be considered curative where the histology shows complete en bloc R0 resection, well-differentiated adenocarcinoma, and sm1 type ( $<1$  mm submucosal invasion) with no lymphovascular invasion [70]. En bloc resection allows optimal histologic assessment of these factors (see below for additional high risk factors). En bloc EMR is generally limited to lesions 20 mm in size, with larger lesions usually requiring ESD or surgery for achievement of en bloc resection [71].

### RECOMMENDATION

ESD can be considered for removal of colonic and rectal lesions with high suspicion of superficial submucosal invasion and which otherwise cannot be removed en bloc by standard polypectomy or EMR. (Moderate quality evidence; strong recommendation.)

Where the risk of submucosal invasive carcinoma within a lesion is considered high, and en bloc EMR or polypectomy is not achievable, ESD or surgery is recommended.

Surgery is currently the gold standard of treatment with no study showing that ESD has better outcomes than surgery [70]. Surgery has the additional benefit of removing the local lymph nodes in most cases. The main exception may be in the rectum where the complexity of the traditional surgical approach with a higher risk of poor functional outcomes and the risk of abdominoperineal amputation might prompt ESD instead of surgery. A surgical transanal approach may be considered; however this also has limitations including the possibilities of difficult access, suboptimal visualization risking incomplete excision, and postoperative complications [70].

Good outcomes from ESD have been demonstrated in Japanese studies, with disease-specific survival rates of 100% at the 3-year and 5-year marks, in a cohort with a median follow-up of 38.7 months (range 12.8–104.2 months) [72]. A systematic re-

view of ESD reported complete resection rates for large colonic polyps of 96% (95%CI 91%–98%) and a per-lesion summary estimate for R0 resection rate of 88% (95%CI 82%–92%) [73]. However, ESD of large colonic lesions is technically difficult, time-consuming, mandates multiday hospital stay, and, in Western countries, limited numbers of endoscopists have sufficient experience and expertise to achieve the results described in the East Asian literature.

According to the ESGE ESD Guideline, colorectal ESD may be considered for lesions with high suspicion of limited submucosal invasion based on depressed morphology or irregular surface pattern, or for lesions that otherwise cannot be optimally and radically removed by snare-based techniques [70]. However, further studies comparing ESD to surgery in a Western setting are required to establish the optimal technique. Local expertise will play a major role in determining which approach is used.

#### RECOMMENDATION

ESGE recommends that successful EMR be defined endoscopically by the absence of neoplastic tissue at the completion of the procedure after careful inspection of the post-EMR mucosal defect and margin. (Low quality evidence, strong recommendation.)

#### RECOMMENDATION

ESGE recommends that endoscopic cure for lesions resected by EMR should be confirmed at surveillance colonoscopy by advanced endoscopic imaging and systematic biopsy. (Low quality evidence; strong recommendation.)

#### RECOMMENDATION

ESGE recommends that suspected residual or recurrent adenoma identified at surveillance colonoscopy is snare-resected within the same procedure. Where snare resection is not possible, ablation should be performed. (Moderate quality evidence; strong recommendation.)

The goal of EMR is to resect the entire lesion, avoiding recurrence or residual tissue. Ideally the lesion should be resected en bloc, with histologically assessed clear margins (R0 resection). Piecemeal resection prevents the histological assessment of complete excision as the snare excision margins divide the polyp and cannot be distinguished from the *in vivo* polyp margins.

Complete endoscopic resection refers to complete removal of endoscopically visible polyp either piecemeal [74–76] or en bloc [77]. Inspection of the margins by magnifying endoscopy at the completion of resection has been shown to result in lower rates of recurrence, in a retrospective case–control analysis [78]. There is however no prospective evidence that use of magnification or high definition endoscopy reduces recurrence.

It has been suggested that extending excision margins may reduce recurrence after EMR [74, 79, 80]; however a prospective observational cohort study of >800 patients failed to show any reduction in recurrence at scheduled surveillance at 4–6 months [81].

Snare resection should be prioritized at the initial resection to remove all polyp, or as much polyp as possible [82]. The detection of residual or recurrent polyp at surveillance colonoscopy is of high importance. Recurrence occurs in 15%–20% of EMRs [83]. There are few studies that have examined the accuracy of endoscopic imaging for the prediction of histological recurrence. Recently a large prospective study using a simple standardized imaging protocol with high definition white light endoscopy followed by NBI showed an NPV for recurrence of 98.6% (95%CI 95.1%–99.8%). The use of NBI in addition to high definition white light endoscopy improved sensitivity for recurrence from 67% to 93%, the difference mainly due to detection of flat recurrence [84].

Residual or recurrent polyp tissue detected at endoscopic surveillance can be effectively treated [60]. Snare resection provides superior outcomes to other modalities [60]. For areas not amenable to snare resection, multiple endoscopic modalities have been described in the past to destroy residual polyp, although none have been demonstrated in a systematic way to reduce recurrence in conjunction with contemporary EMR techniques [85]. Hot avulsion is a technique that can be applied to small areas of non-lifting polyp and was effective in a small prospective study [86, 87]. Alternative strategies for non-lifting polyp including cold avulsion in conjunction with thermal ablation are being investigated. Recurrent lesions with substantial fibrosis may be suitable for ESD resection. The en bloc resection rate in Japanese studies is lower for salvage ESD than for naive lesions [88]. Underwater EMR has been examined in a small study as an alternative salvage therapy, with en bloc resection rates in this setting of 47.2% vs. 15.9% for standard EMR [75].

#### RECOMMENDATION

ESGE recommends the use of advanced endoscopic imaging to identify the potential presence of superficial submucosal invasion. (Moderate quality evidence; strong recommendation.)

Advanced imaging techniques such as narrow band imaging (NBI) and magnifying chromoendoscopy (MCE) have been shown to improve the identification of morphological features suggestive of submucosal invasion, such as irregular or absent surface vascular patterns [89–91]. NBI studies showed that the Sano capillary pattern IIIB, Hiroshima C3, and NBI International Colorectal Endoscopic Classification (NICE) 3 are highly indicative of deep invasion [92–95]. MCE studies demonstrated that Kudo pit pattern Vn is associated with a high likelihood of deep submucosal invasion [96, 97]. Sano IIIA, and Kudo pit pattern Vi are predictive of superficial submucosal invasive carcinoma, and can therefore identify patients who will benefit from en bloc resection.

#### RECOMMENDATION

ESGE suggests that when advanced imaging is not available, standard chromoendoscopy may be beneficial. (Moderate quality evidence; strong recommendation.)

Polyp morphology such as ulceration, excavation, deep demarcated depression, Paris classification II-c and IIa+c, non-granularity, mucosal friability, fold convergence and Kudo pit pattern V are associated with submucosal invasive carcinoma [4, 98–101]. Many of these features may be visible with standard or high definition white light inspection. Even when magnification technology is not available, standard chromoendoscopy may be useful in further enhancing the identification of these features.

#### RECOMMENDATION

ESGE recommends that polyps with advanced endoscopic imaging characteristics of deep submucosal invasion should not be considered for endoscopic treatment and should be referred for surgery. (Moderate quality evidence; strong recommendation.)

Polyps demonstrating endoscopic signs of deep submucosal invasion are at high risk of lymphovascular invasion and lymph node metastasis [102–104]. In a meta-analysis of 23 cohort studies involving 4510 patients, a significantly higher risk of lymph node metastasis was associated with a depth of submucosal invasion > 1 mm compared with superficial invasion (odds ratio [OR 3.87], 95%CI 1.50–10.00;  $P=0.005$ ). Lymphovascular invasion (OR 4.81, 95%CI 3.14–7.37;  $P<0.001$ ), poorly differentiated tumors (OR 5.60, 95%CI 2.90–10.82;  $P<0.001$ ), and tumor budding (OR 7.74, 95% CI 4.47–13.39;  $P<0.001$ ) were significantly associated with lymph node metastasis [104]. Therefore, in addition to excision of the lesion, the local draining lymph nodes must also be removed when deep submucosal invasion is suspected or proven, which can only be achieved by surgery.

#### RECOMMENDATION

ESGE recommends that polyps without characteristics of deep submucosal invasion should not be referred for surgery without consultation with an expert endoscopy center for evaluation for polypectomy/EMR. (Low quality evidence, strong recommendation.)

Polyps without characteristics of deep submucosal invasion, have a high likelihood of being successfully removed endoscopically at expert centers, and these patients should be offered a consultation to discuss endoscopic management before proceeding to surgery [105]. In a recent EMR study, 36 patients with 38 large or complex polyps without biopsy-proven cancer

were redirected to consultation with an EMR expert by a colorectal surgeon who received the original referrals: 79% of lesions could be successfully treated endoscopically and surgery was avoided in 71% of the patients [106].

#### 2.7 Colonic tattooing: which lesions should be tattooed, and what is the best technique and location for tattoo placement?

#### RECOMMENDATION

ESGE recommends that lesions that may need to be located at future endoscopic or surgical procedures should be tattooed during colonoscopy. (Low quality evidence, strong recommendation.)

Colonoscopic tattooing is performed to enable future identification, at colonoscopy or surgery, of malignant lesions (proven or suspected), polypectomy, EMR, or ESD sites, difficult-to-detect polyps, or dysplastic areas. All such lesions, other than those definitely located in the cecum, adjacent to the ileocecal valve, or in the low rectum, should be tattooed.

#### RECOMMENDATION

ESGE recommends sterile carbon particle suspension as the preferred tattoo agent. (Low quality evidence, strong recommendation.)

A variety of substances were previously used for endoscopic tattooing, including india ink, methylene blue, indigo carmine, and indocyanine green [107]. These were limited by difficulties including lack of permanence, infection resulting from impurities, or complex preparation. A sterile and biocompatible pre-packaged suspension containing highly purified and very fine carbon particles (Spot; GI Supply, Camp Hill, Pennsylvania, USA) has been developed for endoscopic tattooing and this has enhanced the accessibility, ease of use, and safety of the procedure [108].

#### RECOMMENDATION

ESGE recommends the formation of a saline bleb in the submucosal layer of the colon prior to tattoo injection. (Low quality evidence; strong recommendation.)

Sterile carbon particle suspension is not biologically inert and has been associated with clinically significant complications [109]. These include reported cases of peritonitis resulting from transmural injection [107, 109, 110] and submucosal fibrosis that makes EMR or ESD difficult and hazardous and has contributed to endoscopic perforation [109, 111]. Furthermore, poor injection technique has resulted in failure to identify the tattoo at surgery [110]. These risks can be reduced by choosing an appropriate location for tattooing [109, 112, 113],

and by the use of the saline bleb injection method [110,114]. The saline bleb injection method involves performing a normal saline injection initially to find the submucosal plane and ensure that a submucosal bleb is safely created. Once the submucosal bleb has been formed, the normal saline syringe is replaced with the tattoo syringe, and injection is recommenced. This ensures tattoo injection into the submucosal plane, avoiding transmural injection that may cause localized peritonitis, and is also associated with more accurate surgical location compared with standard tattooing [110,114].

#### RECOMMENDATION

ESGE recommends that tattoos be placed  $\geq 3$  cm anatomically distal (anal side) to the lesion, with 2 or 3 separate injections being made at this level on opposite sides of the lumen, to increase the likelihood of detection. Endoscopic and surgical team members should agree on a standardized location of tattoo injection at their institution. The details of tattoo injection should be clearly text- and photo-documented in the endoscopy report, using unambiguous terminology. (Low quality evidence; strong recommendation.)

The recommended tattoo location of 2–3 cm distal (on the anal side) to the lesion [109,112,113] is at an adequate distance to limit the likelihood of inadvertent spread beneath the lesion and also avoid inadvertent injection through the lesion that may cause needle-track seeding [109,112,115,116]. The carbon particles can spread a significant and often unexpected distance within the submucosal plane as the submucosal bleb flattens and expands laterally, potentially spreading underneath the lesion and inducing submucosal fibrosis, which can limit subsequent endoscopic therapy.

It is also recommended that 2 or 3 separate injections should be performed at this level of 2–3 cm distal (anal side) to the lesion. One injection should be in line with the lesion, and one should be on the opposite aspect of the lumen. This may increase the likelihood that the tattoo will be seen at future endoscopy or surgery. A tattoo volume of at least 1.0–1.5 mL at each injection site has been recommended [109,110]. A volume of 3 mL of sterile carbon particle suspension has also been suggested if one is confident that the needle-tip is located within the submucosal plane [110].

### 3. Endoscopic mucosal resection (EMR) for sessile laterally spreading lesions $\geq 20$ mm in size

EMR involves injection of a solution into the submucosal space to separate a mucosal lesion from the underlying muscularis propria. The lesion can then be resected by snare electrosurgery. The submucosal cushion theoretically reduces the risk of thermal or mechanical injury to the underlying muscularis propria.

Sessile and flat colorectal laterally spreading lesions (LSLs) (or laterally spreading tumors [LSTs])  $\geq 20$  mm in size require advanced techniques for resection. Large prospective studies

have demonstrated that EMR is safe and efficacious [4,63,117]. There is now a growing evidence base for several key technical aspects of the procedure, aimed at improving complete resection rates, reducing recurrence, and lowering rates of complications including perforation, bleeding, and post-procedural pain. Advanced endoscopic resection requires a patient- and lesion-centered approach, where the endoscopist must carefully appraise the risks of submucosal invasive cancer, the risks and benefits of resection techniques, and the co-morbidities of the patient. Although EMR is effective and safe for the vast majority of sessile flat colorectal LSLs without imaging features suggestive of invasive disease, surgical resection or endoscopic submucosal dissection (ESD) may be appropriate alternatives for higher risk lesions.

#### RECOMMENDATION

ESGE recommends careful lesion assessment prior to EMR to identify features suggestive of poor outcome. Features associated with incomplete resection or recurrence include lesion size  $>40$  mm, ileocecal valve location, prior failed attempts at resection, and size, morphology, site, and access (SMSA) level 4. (Moderate quality evidence; strong recommendation.)

Large polyp size as a predictor of recurrence or failed endoscopic therapy has been demonstrated in several studies [4,55,61,118]. Prior attempts at resection have been shown to be associated with failed subsequent endoscopic resection. Non-lifting due to previous intervention was associated with failed resection in the large prospective Australian Colonic EMR (ACE) study (OR 3.75) [60] and a US study identified prior resection attempts as a risk factor for failure of complete resection (OR 0.081;  $P < 0.001$ ), or recurrence (OR 18.8;  $P < 0.001$ ) [119]. Lesion location may be associated with incomplete resection. Lesions at the ileocecal valve were associated with failed resection in the ACE study (OR 2.61) and, although good endoscopic outcomes can be achieved in this location, involvement of the ileum or both the superior and inferior lips of the valve was associated with recurrence [120]. Other locations that may prove challenging include the appendiceal orifice and anorectal junction [121]. Methods to overcome these challenges have been described and prospectively studied [120,121]. Difficult access was associated with failed endoscopic resection in the ACE study [4] (OR 2.17), and locations behind folds, in a constrained sigmoid colon, or in peridiverticular locations may also reduce complete resection rates.

Post-EMR bleeding occurs in 5%–7% following resection of lesions  $\geq 20$  mm [122,123]. Identified risk factors for bleeding include proximal colon location [48,122,124] and increasing lesion size, especially  $\geq 40$  mm [77,125]. The combined effects of size and location in the English Bowel Cancer Screening Programme identified a predicted risk of bleeding of 1 in 8 [125]. Perforation is an uncommon event, and meta-analyses show pooled estimates of 1.4%–1.5% [123,126]. Few studies have identified independent risk factors for perforation as analyses

are prone to error when there are few outcomes. In large series examining standard polypectomy, “adverse event” outcomes (combining bleeding and perforation) have identified endoscopist inexperience and increasing lesion size as risk factors [127–130].

A simple method for stratifying lesion complexity, based on the size, morphology, site, and access (SMSA), has been developed by a working group of UK experts [131]. This stratifies polyps into four levels of difficulty with level 1 being the easiest and level 4 being very difficult to resect. Validation of this system in 220 lesions  $\geq 20$  mm in size demonstrated higher complication rates (8.6% vs. 0%,  $P=0.007$ ) and lower clearance rates (87.5% vs. 97.5%,  $P=0.009$ ) for SMSA level 4 polyps as compared to SMSA level 2 and 3 [55]. The classification is user-friendly, takes account of most described risk predictors and may be valuable for the assessment of large and complex polyps.

Lesions that have high risk features suggesting poor outcomes may be more safely and effectively handled at a high volume tertiary referral centre. The endoscopist must be confident that the resources available to them (staff, equipment, time, and endoscopic skill) are sufficient to remove the entire lesion safely and manage potential adverse events. If not, referral to a tertiary care center should be strongly considered [57,61].

#### RECOMMENDATION

ESGE recommends that the goals of EMR are to achieve a completely snare-resected lesion in the safest minimum number of pieces, with adequate margins, and without need for adjunctive ablative techniques. (Low quality evidence; strong recommendation.)

Effective resection technique relies on multiple interdependent factors, but is difficult to study objectively as it requires the intersection of a number of endoscopic skills, including optical diagnosis, endoscope shaft and tip control, injection technique, snare selection and manipulation, visual and haptic feedback, and judgment. Several sources including technical reviews and expert opinion are available to guide technique [78, 82,132,133].

Complete and safe excision often requires an adaptable approach to the lesion and the techniques employed may vary slightly between operators. Factors associated with the lowest recurrence risk are complete snare resection, en bloc or oligo-piecemeal excision, and the absence of adjunctive thermal ablative techniques.

#### RECOMMENDATION

ESGE suggests the use of submucosal injectates for EMR that are more viscous than normal saline and whose safety has been proven, including succinylated gelatin, hydroxyethyl starch, or glycerol, since their use is associated with superior technical outcomes and reduced procedural time. (High quality evidence; weak recommendation.)

#### RECOMMENDATION

ESGE recommends that a biologically inert blue dye such as indigo carmine should be incorporated into the submucosal injection solution to facilitate identification of fluid cushion extent, lesion margins, and deep mural injury. (Moderate quality evidence; strong recommendation.)

The ideal submucosal injectate should provide a sustained lift, facilitate en bloc or oligo-piecemeal resection, be inexpensive, widely available, and have few adverse effects [134]. The traditional EMR submucosal injectate is normal saline; however several other solutions have been investigated [135, 136].

Succinylated gelatin (Gelofusine; B. Braun, Crissier, Switzerland), has been compared to normal saline in an Australian double-blind RCT of EMR for lesions  $\geq 20$  mm ( $n=80$  patients). Succinylated gelatin results in fewer snare resections per lesion (3.0 vs. 5.5,  $P=0.028$ ) and shorter procedure duration (12.0 min vs. 24.5 min,  $P=0.006$ ) [137]. Succinylated gelatin is not universally available and there is a theoretical risk of an allergic reaction to bovine protein; however it has been used in a large multicenter cohort of over 1000 patients without complications [60].

Hydroxyethyl starch (Voluven; Fresenius Kabi Ltd, Runcorn, UK) has been shown to improve mucosal lift time, reducing the need for additional injections in a randomized controlled study [138]. Hyaluronic acid has also been demonstrated to improve complete resection and prolong mucosal elevation in several animal and human studies [139–142]. It is commonly used in ESD procedures [143]; however it is expensive [144] and not widely available, which has limited its uptake. In addition, murine models have suggested a potential for the stimulation of growth of residual adenoma [145].

Glycerol is a hypertonic solution consisting of 10% glycerol and 5% fructose in normal saline. In a retrospective case–control study, en bloc resection rates were improved with use of glycerol compared with normal saline [146]. Glycerol is widely available and inexpensive in Japan, but is not used extensively elsewhere [144].

Other hypertonic crystalloid solutions have been investigated in human and animal studies. Hydroxypropyl methyl cellulose sustains mucosal lift in animal studies [147] and is non-inferior to normal saline in humans [148–150]. Dextrose solutions produce a sustained mucosal lift [151–153]; however tissue damage has been reported in animal studies, particularly with concentrations over 20% [154]. In a double-blind, randomized human EMR study, post-polypectomy syndrome was significantly more likely in patients treated with submucosal injection of 50% dextrose with adrenaline compared with normal saline with adrenaline [151]. Similar effects have been noted with hypertonic saline [154].

Fibrinogen and blood injectates have also been used for EMR in animal models; however there are concerns regarding pathogen contamination and practicality [155, 156].

Incorporation of a biologically inert dye into the submucosal injectate facilitates identification of fluid cushion extent, lesion margins, and deep mural injury [5, 135]. Topical application of injectate with a chromic agent to resection defects may assist in the delineation of deep injury [157].

#### RECOMMENDATION

ESGE suggests that en bloc EMR should be limited to lesions  $\leq 20$  mm in the colon and  $\leq 25$  mm in the rectum. (Low quality evidence, weak recommendation.)

En bloc resection by EMR for lesions  $\geq 20$  mm is reported in 16%–48% of lesions [60, 61, 79, 158]. It is associated with lower recurrence rates than piecemeal resection in both EMR and ESD studies [60, 143]. No studies have defined a cutoff point for size where en bloc resection is unsafe, so it remains a decision that is based on lesion morphology and location. The factors that limit en bloc resection by EMR are polyp size, location, EMR technique, and the experience of the endoscopist [159]. Finally however the primary driver must be consideration of safety. For flat and sessile colonic lesions the maximum size that can be reliably excised en bloc by EMR is 15–20 mm proximal to the splenic flexure where the risk of perforation is higher, and 20–25 mm in the sigmoid and rectum [160]. If en bloc resection is not possible, the lesion should be removed in as few pieces as possible [160].

Circumferential incision of lesions using ESD techniques (c-EMR, CSI-EMR, or EMR-precut) may allow extension of the size limits while mitigating perforation risk [79, 80, 161]. Use of special devices such as dual-loop snares may also increase the rate of en bloc resection for lesions  $\geq 20$  mm to 64% [162]. Underwater EMR has demonstrated en bloc resection rates of 55% for colorectal lesions of 20–40 mm [163].

#### RECOMMENDATION

ESGE recommends complete snare resection during EMR, because adjunctive thermal ablative techniques (e.g. argon plasma coagulation [APC]) are not as effective and are associated with higher adenoma recurrence. (Moderate quality evidence; strong recommendation.)

#### RECOMMENDATION

ESGE suggests that where complete snare excision cannot be achieved, the optimal method for adjunctive removal of residual adenoma requires further study. (Low quality evidence; weak recommendation.)

#### RECOMMENDATION

ESGE suggests that where complete snare excision EMR has been achieved, the role of adjunctive thermal ablation of the EMR resection margins to prevent recurrence requires further study. (Low quality evidence; weak recommendation.)

Ablation at the margins of the EMR defect may have two roles: as an “adjunct” treatment, where residual tissue not amenable to snare resection is ablated, or as an “adjunct” treatment, where ablation is applied to clean defect margins in an effort to reduce recurrence.

Two small RCTs have demonstrated conflicting results for adjunctive APC, with one showing a significantly reduced rate of recurrence with APC application [164, 165] and the other showing no effect [141]. There are no contemporary high quality studies examining adjunctive thermal ablation techniques.

Small low quality prospective cohort studies have examined adjunctive thermal ablation with APC; however results have been inconclusive [85, 166].

The prospective ACE study (n=479 patients, 514 lesions, mean size 35.6 mm) aimed for a treatment goal of complete snare resection. Where this was not achieved, remnant tissue was ablated by APC or snare-tip soft coagulation. Independent predictors of lesion recurrence included lesion size  $>40$  mm (OR 4.37) and use of APC (OR 3.51) [4]. The role of adjunctive thermal ablation of the post-EMR margin, where no endoscopically visible adenoma remains despite meticulous inspection, requires further rigorous evaluation.

#### RECOMMENDATION

ESGE recommends that when a lesion appears suitable for EMR, but does not lift with submucosal injection, referral should be made to an expert endoscopist in a tertiary center. (Moderate quality evidence, strong recommendation.)

Obliteration of the submucosal space that precludes lesion elevation with submucosal injection may be caused by early colorectal cancer, and with the associated desmoplastic response the mucosal layer can be tethered to the underlying muscularis propria. Fibrosis related to polyp prolapse, prior resection attempts [119, 167], or as a reaction to submucosal injection of tattoo particles [109] may also cause this. Non-lifting is evident when submucosal injection fails to elevate the lesion, but lifts the surrounding mucosa creating a canyoning effect. Infiltration into the submucosal space may not be possible, resulting in a jet of fluid exiting the lesion under pressure.

Non-lifting was first described in 1994 in a prospective series [168] and was strongly associated with submucosal invasion (SMI). It was subsequently shown that superficial SMI (SM1, involvement of the submucosa  $<1000$   $\mu\text{m}$ ; SM2, involvement of the submucosa  $<2000$   $\mu\text{m}$ ) was not as strongly associated with

non-lifting as deep SMI (SM3, >2000 µm involved), as the underlying preserved submucosa may still expand [169]. Other studies have re-demonstrated this association of non-lifting with SM3 disease [170,171]. Kobayashi et al. showed that endoscopic assessment with chromoendoscopy was superior to non-lifting for predicting submucosal invasion [171], so careful endoscopic assessment of surface pattern and morphology is considered to be the optimal method of determining invasion, preferably using magnification endoscopy and digital or topical chromoendoscopy [172].

Endoscopic resection by a typical inject and resect method may be ineffective or incomplete, requiring the use of adjunctive thermal ablation [173] or avulsion techniques (hot or cold) [86,87] to remove all visible polyp. All visible adenoma should be excised before ablation is considered. Good outcomes have been reported at high volume tertiary referral centers [4,61,119] and in series using ESD techniques [88].

#### RECOMMENDATION

ESGE recommends that all EMR specimens be retrieved for histological evaluation. (Moderate quality evidence; strong recommendation.)

Although the Roth retrieval net device is usually used to retrieve polyp fragments after large or piecemeal polypectomy without compromising pathologic evaluation [174], systematic literature search yields no evidence-based data on this point regarding LSLs.

## 4. Equipment considerations for polypectomy and EMR

### 4.1 Type of current

#### RECOMMENDATION

ESGE suggests the use of a microprocessor-controlled electrocautery generator for polypectomy. (Low quality evidence; weak recommendation.)

Electrosurgical units convert energy from high frequency currents (between 300kHz and 1 MHz) into heat. When high frequency electrosurgical current flows from a snare wire through tissue, the high density current at the point of contact results in a sharp rise in tissue temperature.

Cutting currents are produced at temperatures greater than 100°C, which leads to boiling of cellular water and subsequent cellular rupture.

Coagulation currents are produced at temperatures of 70–100°C. This leads to dehydration and contracting of cells, without rupture.

With use of blended currents, the ratio of cells cut to those coagulated can be varied.

For polypectomy, it is recommended that automated microprocessor technologies are used that enable controlled tissue cutting by providing an appropriate blend of cutting and coagulation currents. This provides enough coagulation current to maximize the hemostatic effect and minimize the risk of perforation [175,176].

#### RECOMMENDATION

ESGE recommends against using low power coagulation current for EMR because of the increased risk of post-procedural bleeding. (Low quality evidence; strong recommendation.)

Use of diathermy current for polypectomy varies according to individual practitioner. A North American survey [177] of polypectomy practice of nearly 200 endoscopists demonstrated that 46% favour a blended current, 46% a pure coagulation current, 3% a pure cutting current, and 4% used a variety. More recently an Israeli survey [178] showed similar results, with 42% favouring pure coagulation and 38% blended current with a higher use of pure cutting current at 20%. Pure cutting current is best avoided because of the risk of immediate post-polypectomy bleeding [47].

Pure coagulation current is popular amongst endoscopists because of its efficient hemostatic properties; however, it is well recognised that prolonged use of coagulation results in deep thermal tissue injury [179], increasing the risk of perforation, particularly in the right colon. A large study of nearly 1500 polypectomies [180] retrospectively compared blended versus pure coagulation current. Overall complication rates were the same between the two groups. However, there was a statistically significant difference in the timing of bleeding: for blended current within 12 hours, and for pure coagulation current within 2–8 days. Pure coagulation current when applied for EMR of flat lesions especially in the right colon is likely to increase the risk of perforation and is best avoided.

Use of an electrosurgical current not controlled by a microprocessor was associated with clinically significant post-endoscopic bleeding (OR 2.03;  $P=0.038$ ) [122].

#### RECOMMENDATION

ESGE recommends against using pure cutting current for pedunculated polypectomy because of an increased risk of intraprocedural bleeding. (Low quality evidence; strong recommendation.)

Pure cutting current is not recommended for polypectomy because of the increased associated risk of intraprocedural bleeding. A large, multicenter Korean study [47], with a total of 9336 polypectomies, found that cutting current and inadvertent cold polypectomy had the highest ORs for immediate post-polypectomy bleeding, at 6.95 (95%CI 4.42–10.94) and 7.15, (95%CI 3.13–16.36), respectively. A large retrospective study

[180] also found that immediate post-polypectomy bleeding was observed more with blended current and delayed post-polypectomy bleeding occurred more frequently with coagulation current.

A retrospective review encompassing 4735 polypectomies performed using pure cutting current found that bleeding occurred in 3.1% of the patients. In this study, hemoclips were prophylactically placed at the endoscopist's discretion and a significant proportion of patients (12%) received them [181].

Resection of pedunculated polyp is achieved by cutting the pedicle. This minimizes the risk of perforation as the pedicle is away from the colon wall, but the pedicle could contain a thick vessel. Inadequate coagulation of this vessel can result in catastrophic bleeds. Therefore, it may be logical to use pure coagulation current for resection of pedunculated polyps. However, there are no high level data comparing pure coagulation current to microprocessor controlled current for pedunculated polyps.

## 4.2 Carbon dioxide (CO<sub>2</sub>) insufflation

### RECOMMENDATION

ESGE suggests the use of carbon dioxide (CO<sub>2</sub>) insufflation during colonoscopy and polypectomy. (Low quality evidence, strong recommendation.)

Carbon dioxide (CO<sub>2</sub>) is absorbed >100 times more quickly than air and can reduce patient discomfort during and after the procedure. A meta-analysis of 9 RCTs involving 1577 patients showed fewer patients with intraprocedural abdominal pain in the CO<sub>2</sub> group (relative risk [RR] 0.77, 95%CI 0.62–0.96). Use of CO<sub>2</sub> also reduced immediate post-procedural pain at 1 hour (RR 0.26, 95%CI 0.16–0.43) and 6 hours (RR 0.36, 0.20–0.64), and post-procedure discomfort at 24 hours (RR 0.53, 0.31–0.91) though there was no significant difference in cecal intubation rate [182].

An RCT assessing the impact of CO<sub>2</sub> insufflation on toilet use after screening colonoscopy showed that at 2 hours post-procedure, 30% in the CO<sub>2</sub> group had used the toilet at least once, compared to 83% in the air insufflation group ( $P<0.001$ ). The average duration of each toilet visit was also significantly shorter in the CO<sub>2</sub> group [183].

### RECOMMENDATION

ESGE recommends the use of CO<sub>2</sub> insufflation for EMR. (Moderate quality evidence; strong recommendation.)

EMR is associated with a higher risk of perforation than standard colonoscopy.

Performing EMR also lengthens the procedure time and the duration of gas insufflation. A prospective cohort study of patients undergoing EMR of large colonic lesions demonstrated a 62% reduction in the number of post-procedure admissions

when CO<sub>2</sub> insufflation was used compared to air (8.9% vs. 3.4%,  $P=0.01$ ) [184]. CO<sub>2</sub> insufflation is advisable in case EMR leads to perforation, as use of CO<sub>2</sub> will allow clinicians more time to manage the perforation as compared to use of air which can lead to rapid abdominal distension, tension pneumoperitoneum, gas tracking, pain, and hemodynamic compromise.

## 4.3 Type of snare

Limited data exist that compare the roles of different types of snares. We recommend that clinicians use snares with which they are familiar and whose performance characteristics are known. Snare size should be appropriately selected depending on the size and morphology of the polyp. Snares come in different shapes (circular, oval, hexagonal, etc.) but no clear benefit of one shape over the other has been demonstrated. Structurally, snares are either monofilament or polyfilament. The potential advantage of monofilament snares is that the snare wire is thin (<0.4mm), so current density is greater, tissue transection swifter, and unintentional diathermic injury to the colonic wall less likely. The potential advantage of polyfilament snares are that the wire is thicker (0.4mm–0.5mm) and thus they may better grip the mucosal surface (depending on what other performance enhancements have been included in the wire design) enabling more effective capture of flat polyps. However, these differences in performance have not been proven and ESGE strongly recommends further research in this field.

## 4.4 Fluid pump

### RECOMMENDATION

ESGE suggests the use of a fluid jet pump to enable efficient irrigation of the colonic mucosa and polypectomy sites and management of bleeding. (Low quality evidence; weak recommendation.)

Use of a fluid jet can be very effective in locating the exact point of bleeding during polypectomy or EMR. This fluid may be water or normal saline. If the fluid jet is delivered via a separate dedicated channel in the endoscope (as in most modern endoscopes) then the working channel of the endoscope is available for the endoscopist to employ hemostatic devices whilst the fluid jet is delineating the precise bleeding point.

## 5. Polypectomy-associated adverse events: definitions and management

### 5.1 Bleeding

Consensus on the definition of post-polypectomy bleeding is lacking. Definitions vary throughout the literature. For the purposes of these guidelines, two terms were used: intraprocedural bleeding and post-procedural bleeding. These were defined as follows:

- Intraprocedural bleeding (IPB) is bleeding occurring during the procedure that persists for more than 60 seconds or requires endoscopic intervention.

- Post-procedural bleeding (PPB) is bleeding occurring after the procedure, up to 30 days post-polypectomy, that results in an unplanned medical presentation such as emergency department visit, hospitalization, or re-intervention (repeat endoscopy, angiography, or surgery).

#### RECOMMENDATION

For intraprocedural bleeding, ESGE recommends endoscopic coagulation (snare-tip soft coagulation or coagulating forceps) or mechanical therapy, with or without the combined use of dilute adrenaline injection. (Low quality evidence; strong recommendation.)

IPB occurs in 2.8% of patients undergoing standard polypectomy [49] and in 11.3% of patients with lesions  $\geq 20$  mm treated with endoscopic mucosal resection (EMR) [122] and it is rarely serious. Management of IPB can be achieved with endoclips, coagulation forceps, and snare-tip soft coagulation. Snare-tip soft coagulation has been shown to be an effective method of IPB control [185]. Coagulating forceps are reserved for more severe cases [82, 132]. Vigorous irrigation, preferably by using a water pump, improves visualization and may aid cessation of bleeding originating from small vessels [82, 132]. Adrenaline injection (1:10 000 or 1:20 000 dilution with saline) may be used to gain initial control of active bleeding but should always be used in combination with a second mechanical or thermal hemostatic method.

IPB that occurs after removal of a pedunculated polyp, can be managed by placing a clip or an endoloop. In cases of immediate massive IPB, the snare may be used to resnare the remaining stalk with temporary control of bleeding providing time for subsequent clip or endoloop application. Where a significant volume of blood is pooling and overlying the bleeding point, this can make it difficult to identify and treat the precise bleeding point. In such a case, rolling the patient so that the bleeding point is away from the gravity-dependent position will enable the bleeding point to be clearly visualized and treated. The over-the-scope clip (OTSC; Ovesco Endoscopy, Tuebingen, Germany) has also been shown to be effective for control of IPB that is refractory to other endoscopic modalities [186]. The advantage of using this device is that it can grasp a much wider area and larger volume of tissue than the through-the-scope endoclips; however withdrawal of the endoscope to load the device is necessary, further delaying hemostasis.

#### RECOMMENDATION

ESGE does not recommend routine endoscopic clip closure or other methods of prophylaxis to prevent delayed bleeding for sessile polyps. (Moderate quality evidence; weak recommendation.)

An RCT, has reported that prophylactic clip application does not decrease PPB after EMR [187]. However, in an uncontrolled retrospective study of 524 unselected polyps  $\geq 20$  mm in size, prophylactic clipping of resection sites was found to reduce the risk of PPB [188]. More RCTs on this subject are required. Moreover, in another RCT, prophylactic endoscopic coagulation of nonbleeding visible vessels within the mucosal defect after wide-field EMR, using coagulation forceps at fixed low power, did not reduce the incidence of PPB [189].

#### RECOMMENDATION

ESGE suggests that there may be a role for mechanical prophylaxis (e.g. clip closure of the mucosal defect) in certain high risk cases after polypectomy or EMR. This decision must be individualized based on the patient's risk factors. (Low quality evidence; weak recommendation.)

Factors associated with the incidence of post-procedural bleeding (PPB) are either related to polyp characteristics such as size, morphology, and location of the polyp, or to the patient's health status such as age  $> 65$  years, the presence of hypertension, renal disease, and use of anticoagulant. PPB complicates 6%–7% of wide-field EMRs [122]. Data from EMR of sessile colorectal polyps  $\geq 20$  mm in size showed, that PPB was associated with proximal location, use of an electrosurgical current not controlled by a microprocessor, occurrence of IPB, and aspirin use [122, 124]. In the Munich Polypectomy Study, polyp size and the proximal location of the polyp were risk factors for adverse events such as PPB [128]. A meta-analysis has shown that the risk of PPB was significantly increased for patients using clopidogrel [190]. A cost-efficacy decision analysis of prophylactic clip placement after endoscopic removal of large polyps has shown that this strategy appears to be cost-effective for patients who receive antiplatelet or anticoagulation therapy [191]. Prophylactic endoscopic clipping may thus be considered for preventing delayed bleeding in patients receiving antiplatelet or anticoagulant medications [192].

The use of mechanical prophylaxis in certain high risk cases after standard polypectomy or EMR should be individualized on the basis of patient or polyp risk factors. A clinical risk score derived from a prospective multicenter dataset of more than 2000 colonic EMRs has recently been described. Importantly, it is simple to use and independently confirms the key risk factors identified in previous studies [193], including lesion size  $> 30$  mm, proximal colon location, and presence of major co-morbidity. Further research regarding prophylactic therapies in this high risk group is required.

### RECOMMENDATION

Patients admitted to hospital with delayed bleeding who are hemodynamically stable, without ongoing bleeding, may be initially managed conservatively. If intervention is required, ESGE recommends colonoscopy as the first-line investigation. (Moderate quality evidence, strong recommendation.)

PPB is one of the most common causes of lower gastrointestinal bleeding amenable to endotherapy [194]. Not all patients presenting with PPB need urgent colonoscopy; however a clear means of identifying those that do has not been defined. No relevant study has been conducted and only expert opinion exists. Patients responding to resuscitation should initially be observed [195]. If bleeding persists, patients should be given an adequate bowel preparation and repeat colonoscopy performed [196,197]. Using a decision model it was calculated that a tandem colonoscopy for identification and treatment of PPB is beneficial in about 22% of patients [198]. In a multicenter, prospective study of colonic lesions  $\geq 20$ mm treated by EMR, 55% of patients avoided repeat colonoscopy because bleeding spontaneously stopped. When colonoscopy was performed, endoscopic therapy was only necessary in 21 of 27 cases (70%). On the basis of these data, a risk-based algorithm for the management of PPB has been proposed [199].

### RECOMMENDATION

When the polypectomy site is identified during colonoscopy for post-polypectomy bleeding, and active bleeding or other high risk stigmata are identified, ESGE recommends forceps coagulation or mechanical therapy, with or without the combined use of dilute adrenaline injection. (Moderate quality evidence; strong recommendation.)

The optimal technique for achieving endoscopic hemostasis in cases of active PPB or other high risk stigmata has not been determined. Technique selection is based on location and characteristics of the lesion, endoscopist preference and experience, and device availability. The most commonly used methods are clipping, or forceps coagulation with or without the combined use of adrenaline injection [124, 195, 200, 201]. Clipping, with or without adrenaline injection, may be superior to forceps coagulation therapy since it limits further tissue injury. Caution is necessary during the application of hemostatic techniques, as transmural injury from thermocoagulation and perforation during clipping have been reported among other complications [124]. Endoscopic band ligation has also been used to manage PPB in cases of pedunculated or semipedunculated polyps [202, 203].

## 5.2 Prevention of perforation

### RECOMMENDATION

ESGE recommends careful inspection of the post-resection mucosal defect to identify features of or risk factors for impending perforation. Where these risk factors are identified, clip closure should be performed. (Moderate quality evidence; strong recommendation.)

Careful analysis of the post-resection mucosal defect is a critical part of polypectomy, particularly in wide-field EMR. Injury to the muscularis propria layer should be identified before it becomes a frank perforation where surgical treatment is mandatory. Full-thickness perforation needs immediate closure endoscopically or surgically [204]. Thorough inspection of the post-EMR specimen and resection defect may reveal the “target sign,” a marker of either partial- or full-thickness muscularis propria resection and imminent perforation. In these cases, immediate endoscopic clipping is indicated [5, 205]. Incorporation of a blue chromic dye into the submucosal injectate facilitates inspection of the submucosal defect which should appear as a relatively homogeneous blue mat of intersecting obliquely oriented submucosal fibres. Topical submucosal chromoendoscopy is a simple and effective technique that rapidly confirms the level of resection and may improve detection of intraprocedural perforation [157]. Endoscopic signs such as exposure of the muscularis propria layer, submucosal fibrosis, or submucosal fat should be noted and further evaluated by topical submucosal chromoendoscopy. Areas that stain poorly because of submucosal fibrosis should be treated by clip closure, since they do not allow endoscopic exclusion of muscularis propria injury and carry a risk of delayed perforation [82, 206].

Risk factors for deep mural injury include attempted en bloc snare excision for lesions  $\geq 25$  mm, high grade dysplasia/early cancer, and transverse colon location.

## 5.3 Audit of adverse events

### RECOMMENDATION

ESGE recommends audit of adverse events. (Moderate quality evidence; strong recommendation.)

Methods of collecting data on adverse events following endoscopic procedures, including colorectal polypectomy, are not uniform and vary from nonsystematic self-reporting to complete registry reporting including linkage to databases other than endoscopic ones. One study revealed that the different methods of collecting data may result in up to 3.1-fold differences in reported frequency of adverse events [206]. A uniform methodology for auditing immediate and delayed (up to 30 days) adverse events is required and studies on completeness of data are needed. One such methodology of auditing polypectomy complications was described in a study from Munich

[128]. Other proposals include the creation of obligatory national databases of adverse events, as proposed in the Netherlands, together with systematic quality assurance programs. Additionally, ESGE guidelines concerning definitions and reporting of adverse events should be followed and usage should be audited [205].

However, currently no systematic audits concerning polypectomy complications are functioning outside of research studies. Optimally an audit should contain: (a) immediate self-reporting by the endoscopic service; (b) 30-day structured telephone interview or patient questionnaire followed by telephone contact, in the case of no face-to-face contact; and (c) linkage to a national hospitalizations database.

## 6. How is the histology specimen best managed and reported upon? Processing, analysis, and reporting (minimum reporting standards)

### RECOMMENDATION

ESGE recommends that polypectomy specimens be placed in separate containers, one for each lesion. Local factors may play a role in whether this is feasible. Fixation should be by buffered 10% formalin. The pathologist should measure the size of each specimen in millimeters. (Moderate quality evidence; strong recommendation.)

### RECOMMENDATION

ESGE suggests that large ( $\geq 20$  mm) sessile lesions removed en bloc, or lesions suspicious for submucosal invasion removed piecemeal, should be pinned to cork to optimize histological assessment. (Low quality evidence; weak recommendation.)

### RECOMMENDATION

ESGE recommends that specimens be sliced and totally embedded, allowing the identification of the deep and lateral margins. (Moderate quality evidence; strong recommendation.)

The pathological work-up of the resection specimens plays a central role in the management of patients undergoing colorectal polypectomy. The quality and accuracy of the histopathological diagnosis directly affect clinical management and decision-making, ranging from surveillance to further local and/or major resection. Multidisciplinary evidence-based guidelines for quality assurance in colorectal cancer screening have recently been developed by a group of experts in a project coordinated by the International Agency for Research on Cancer (IARC) and co-funded by the Public Health Programme of the European Union [207]. The guidelines' pathology content has been published in four papers in both pathological [208, 209] and clinical [210, 211] journals. These publications define

the current standard of care in the pathological work-up of polypectomy specimens, in Europe and beyond. The following subsection is a brief summary.

### 6.1 Technical considerations

Specimen handling is an important issue, as poor handling and dissection procedures can impair diagnostic accuracy. Specimen handling starts with the endoscopic removal and ends with the histopathological diagnosis and report [208, 210]. It is recommended that specimens be placed in separate containers, one for each lesion. This helps to avoid confusion about the exact location of the lesion(s), and also increases the accuracy of histopathological diagnosis by avoiding false-positive diagnoses of mixed lesions, e.g. sessile serrated adenomas with dysplasia. Biopsies from the same lesion can be placed in the same container. Fixation should be by buffered 10% formalin. Specimens can shrink due to formalin fixation, therefore measurements taken after fixation can differ from those prior to fixation [208, 210].

Size is an important objective measurement, best performed by the pathologist. Pathology measurements are auditable, accurate, and simple to perform [210]. Lesion size should be given in millimeters. If possible, the maximum size should be measured from the histological slide, and only measured from the formalin-fixed gross specimen if the lesion is disrupted or too large [211].

Polypoid lesions must be sliced and totally embedded. While smaller lesions may be bisected through the stalk, larger lesions should be trimmed to generate a central section containing the intact stalk for further analysis. As the pathology report should verify the complete removal of a neoplastic lesion, special attention needs to be paid to the evaluation of the resection margin, which should be identified and described (broad, stalked, etc.) and either dissected tangentially into an extra cassette or sliced in a way that allows complete assessment [208, 210].

It is recommended that the resections of sessile or flat lesions be pinned out (mucosal surface upwards), e.g. on a piece of cork or other suitable material, by inserting pins through the periphery of the specimens. Needles should not be placed directly through a lesion. After fixation, the specimens are described and sectioned transversely into 3-mm slices (submitted for histological evaluation in sequentially labelled cassettes), thereby allowing the identification of involvement of the deep and lateral margins. Particular attention should be paid to any areas of ulceration or induration for signs of invasion [208, 210].

Piecemeal resection precludes a reliable assessment of completeness of resection. Whenever possible, the entire lesion should be embedded to allow exclusion of invasive malignancy.

Inking of margins is recommended. The distance to the excisional margin should be reported in millimeters. The European guidelines recommend that clearance of 1 mm or less indicates margin involvement [208, 210]. Cases of incomplete removal should be highlighted, which is most important for advanced adenomas and early cancer. Three or more levels should be cut through each block and stained with hematoxylin and eosin [208, 210].

## 6.2 Adenoma grading, and reporting of cytological dysplasia

### RECOMMENDATION

ESGE recommends the grading of adenomas/neoplasia as low grade or high grade according to the World Health Organization (WHO) classification. (High quality evidence; strong recommendation.)

### RECOMMENDATION

ESGE recommends that sessile serrated adenomas/polyps should be reported as containing cytological dysplasia when it is present. (Moderate quality evidence; strong recommendation.)

## 7. Diagnosis of lesions in the adenoma–carcinoma sequence

### 7.1 Lesion types

*Colorectal adenoma* is defined as a lesion in the colon or rectum containing unequivocal (intra)epithelial neoplasia (dysplasia) [212]. Classification of adenomas should include grading of neoplasia according to the revised Vienna classification to apply a two-tiered categorization of low grade and high grade neoplasia. This system aims to minimize intraobserver and interobserver variation and to facilitate the management of endoscopically detected lesions by improving correlation between the histopathology of biopsy and resection specimens.

Most adenomas measure less than 10 mm in size and have tubular architecture. Villous architecture is defined as leaflike or fingerlike projections of epithelium overlying a small amount of lamina propria. Tubulovillous adenomas are defined by a mixture of tubular and villous structures, with arbitrary percentages in different studies, typically with between 25% and 75% villous component. Grading of neoplasia is performed by assessing the degree of architectural complexity, the extent of nuclear stratification, and the severity of abnormal nuclear morphology [213].

Approximately one third of colorectal cancers develop from serrated lesions, a heterogeneous group of lesions characterized morphologically by a serrated (sawtoothed or stellate) architecture of the epithelial compartment. Hyperplastic polyps, sessile serrated adenomas/polyps, and traditional serrated adenomas are the lesions included in this group [213].

*Hyperplastic polyps* are very common, accounting for 70% to 95% of all serrated lesions, or 25%–30% of resected polyps [214, 215]. They occur as usually small (<5 mm) nondysplastic polyps in the left colon, particularly the sigmoid colon and rectum, and only rarely in the right colon [213–215].

*Sessile serrated adenomas/polyps* are more likely to be located in the right colon (75%), accounting for approximately 5%–25% of all serrated lesions [213, 216]. Their size is larger than that of hyperplastic polyps: More than half of the lesions measure >5 mm and 15%–20% of the lesions >10 mm, respectively.

They may develop de novo or from pre-existing hyperplastic polyps. Upon histological examination, sessile serrated adenomas/polyps show distorted crypt architecture, with hyperserration, often at the base of the crypts, and with dilated, mucus-filled, L-shaped (“boot”) and T-shaped (“anchor”) crypts [214–219]. Uncomplicated sessile serrated adenomas/polyps are nondysplastic, but they may acquire overt dysplasia during tumor progression, often in conjunction with methylation of the *hMLH1* gene promoter [213–215, 217].

*Traditional serrated adenomas* are rare, accounting for only about 1% of colorectal polyps. They prevail in the left colon. They are often polypoid or pedunculated, but sessile lesions do also occur, predominantly in the right colon [220, 221].

*Early colorectal cancer* is defined as invasive adenocarcinoma invading into but not beyond the submucosa [212]. The term ‘malignant polyp’ refers to an adenoma that appears benign endoscopically, but which shows invasion through the muscularis mucosa into the submucosa upon histological assessment. A malignant polyp is therefore an early carcinoma. Malignant polyps account for 0.75% to 5.6% of large-bowel polyps removed in general diagnostic colonoscopy practice [102].

Patient management following endoscopic removal of a malignant polyp is difficult because of the potential risk of residual cancer tissue within the bowel wall and/or metastatic cancer spread to regional lymph nodes. The depth of invasion into the submucosal layer, assessed according to the Haggitt classification [17, 102] (for pedunculated lesions), the Kikuchi classification [222] (for nonpolypoid lesions), or by direct measurement (in microns from the bottom line of the muscularis mucosae), has been associated with regional lymph node spread. Angioinvasion, in particular lymphatic invasion, poor tumor differentiation or grade, and resection margin status have been identified as additional risk factors [223, 224]. The combined assessment of these features increases the accuracy of risk prediction [102, 225, 226] and allows the stratification of patients into low risk and high risk groups [102, 227, 228].

### 7.2 Histological findings that require further action

#### RECOMMENDATION

ESGE recommends that where submucosal invasion is present, the depth of invasion should be measured and reported, in addition to other risk factors, such as poor differentiation, lymphovascular invasion and tumor budding. The distance to the deep/vertical and to the lateral/horizontal resection margin should be measured and reported. (Moderate quality evidence; strong recommendation.)

#### RECOMMENDATION

The opinion of a second histopathologist may be warranted when reviewing high risk features. (Low quality evidence; weak recommendation)

Endoscopic resection is an effective cure for colorectal lesions confined to the mucosa. Invasion across the muscularis mucosa into the submucosa constitutes T1 disease. Complete resection of a T1 lesion is often readily achievable; however even if completely resected, T1 tumors are associated with a risk of lymph node metastasis (LNM) which, if present, has a significant impact on survival and cure. The 5-year survival for a T1 lesion without LNM (stage 1) is >95%, whereas T1 disease with any LNM (stage III) reduces overall 5 year survival to 68.4%–87.6% [229]. Surgery and lymph node dissection is essential in those with suspected LNM to completely stage the disease and improve outcomes.

LNM is present with a minority of T1 cancers (6.3%–17.6%) (see Table 14, **Appendix 2**; available online in Supplementary material); thus the majority of patients may be cured by endoscopic resection alone. Although definitive, surgery for colorectal cancer is costly, invasive, and can be associated with significant morbidity and mortality [66, 230]. Risk stratification of T1 lesions is therefore important to identify patients at low risk of LNM who may safely avoid surgery.

There are a large number of studies that aim to address risk factors for LNM; however the majority are small and retrospective. Many studies are restricted to surgically resected tumors, potentially producing a bias towards larger and higher grade lesions. The most commonly identified risk factors for LNM are deep vertical penetration (submucosal invasion > 1000 µm for flat or sessile lesions and Haggitt level 4 for pedunculated lesions), lymphovascular invasion, poor tumor differentiation, tumor budding, and a positive resection margin. There are no identified clinical or patient features which are reliably associated with LNM, aside from rectal location [224].

### 7.3 Submucosal invasion depth

Methods for classifying the extent of submucosal invasion vary depending on the morphology of the polyp, and are prone to interobserver variation. The most established classification methods are Haggitt levels [102] for pedunculated lesions and Kikuchi levels [222] for flat or sessile lesions.

The Haggitt classification divides the polyp into five zones. Level 0 is noninvasive disease which does not cross the muscularis mucosa. Levels 1–4 describe progressive involvement of head, stalk, and submucosa below the stalk. In a small series (n = 129), Haggitt et al. showed that the deepest level of invasion (level 4) was associated with LNM or death from colorectal cancer [102]. The system is widely adopted, and endoscopically resected level 1–3 disease has been shown to be associated with a low risk of LNM [103, 231]. Despite this, studies have described LNM with 6.2%–8.0% of polyps with level 3 invasion [232]. Pathological assessment of Haggitt levels may be hampered by endoscopic trauma and cautery artefact during removal, by shrinkage after fixation, and by suboptimal tissue orientation due to the plane of sectioning.

For nonpolypoid lesions, depth of submucosal invasion can be classified using the Kikuchi level system. Kikuchi et al. adapted an existing schema whereby sm1, sm2, and sm3 denote the upper, middle, and lower thirds of the submucosa respectively [14]. Reported risks of LNM are 0–3% for sm1 in-

vasion, 8%–10% for sm2, and 23%–25% for sm3 [222, 233]. The classification cannot be applied when lesions have been resected endoscopically, as the muscularis propria is not included. As a result, some authors have proposed using a measurement of the distance of invasion from the muscularis mucosa. Ueno et al. described an elevated risk of LNM when invasion extends deeper than 2000 µm beyond the muscularis mucosa (2.5% vs. 18.2%) or when the invasion width is >4000 µm (3.9% vs. 17.1%) [225]. In a retrospective UK study, invasion width (> 11.5 mm) and area were also found to be risk factors for LNM after multivariable adjustment for other significant risk factors (grade of differentiation, lymphatic and vascular invasion) [234]. Four meta-analyses have shown that invasion >1000 µm is a risk factor for LNM, although all four studies comment on the small sizes, heterogeneity, and retrospective nature of the included papers [104, 224, 235, 236].

### 7.4 Lymphovascular invasion

The majority of studies examining histological risk factors for LNM report on lymphatic or vascular invasion. Five meta-analyses have all demonstrated that lymphatic or lymphovascular invasion is one of the stronger risks for LNM [104, 224, 235–237]. In patients undergoing surgery for T1 lesions, lymphatic invasion is reported in 27%–31% and approximately 27% of these patients have LNM. Vascular invasion, when separately reported, is seen in 19% with LNM in 21%–24% [224, 235].

It may be difficult to detect lymphatic invasion by standard light microscopy because of retraction artifact, which can result in an artificial space surrounding tumor nests that mimics a lymphatic channel. The use of immunohistochemistry with an antihuman podoplanin antibody such as D2–40 may improve the ability to detect and characterize lymphoid invasion [238]. A meta-analysis of histopathological predictive factors showed that the strongest predictive factors for LNM were lymphatic vessel invasion identified by an antihuman podoplanin antibody (OR 5.19, 95%CI 3.31–8.15; *P*=0.01) or tumor budding (OR 7.45, 95%CI 4.27–13.02; *P*=0.0077) [237]. Immunohistochemical markers such as D2–40 are not in widespread use.

### 7.5 Tumor differentiation

Grading of colorectal carcinomas should be performed according to the WHO classification, and tumors are graded as well-differentiated (>95% gland formation), moderately differentiated (50%–95% gland formation), or poorly differentiated (<50% gland formation). Carcinomas may be heterogeneous, so the tumor should be graded according to the least differentiated component. The interobserver agreement between pathologists when grading colorectal adenocarcinoma specimen is fair at best, and it has been suggested that use of the high grade and low grade categories should be standardized [239].

High grade, or poorly differentiated tumors are associated with LNM and residual disease following endoscopic resection. In a pooled analysis of retrospective studies, Hassan et al. reported poor differentiation in 116/1612 polyps (7.2%) [227]. In patients with poor differentiation LNM was apparent in 23%

compared to 7% with low grade changes. Poor differentiation was also associated with hematogenous metastases and mortality. A meta-analysis of sessile early colorectal cancer showed an RR of 8.19 (95% CI 4.65 – 14.43) for LNM in poorly compared to well-differentiated tumors and of 3.48 (95% CI 2.08 – 5.81) for poor compared to moderate differentiation [236]. Two other meta-analyses of more heterogeneous studies also confirmed this association of LNM with poor differentiation with RRs of 5.60 (95% CI 2.90 – 10.82;  $P < 0.001$ ) [104] and 4.8 (95% CI 3.3 – 6.9;  $P < 0.001$ ) [224].

### 7.6 Tumor budding

Budding refers to the presence of single cells or small groups of tumor cells scattered within the stroma at the leading edge of invasion. Several studies have identified this feature as a risk factor for LNM [240, 241], and it is associated with venous and lymphatic invasion [242] as well as with poorer outcome in colorectal cancer [243]. In early colorectal cancer, tumor budding has been reported primarily in Japanese studies. Its assessment suffers from a lack of standardized international criteria. Usually, budding is either described as present or absent, or it is graded. Despite this lack of conformity (high grade) budding has been associated reliably with LNM and has hence been identified as a strong and independent predictor of LNM in five meta-analyses [104, 224, 235 – 237]. Prospective studies, and a consensus definition for the reporting of tumor budding are required for the inclusion of this characteristic in standard histopathological reporting of T1 cancer.

### 7.7 Resection margin

Involvement of the deep resection margin is associated with residual tumor, hematogenous metastasis, and mortality [225, 227, 244]. Margin involvement should be reported routinely by the pathologist and clearance from the resection margin should be described and measured in millimeters.

There is no generally accepted consensus definition, and a positive margin has been defined variably as cancer within the diathermy margin, within one high power field of the margin [225, 245, 246], 0.1 mm or less from the margin [247], 1 mm or less from the margin [248, 249], or 2 mm or less from the margin [250, 251]. Residual tumor or recurrence is  $< 2\%$  where the margin of resection is  $> 1$  mm and in the absence of other unfavorable histological features [223, 247, 252, 253]. Cunningham et al. reported that in the absence of unfavorable factors, 16.6% of polyps with a margin clearance  $\leq 1$  mm had residual disease at surgery [254]. Cooper et al. showed in a retrospective single-center study that in patients without risk factors but where margin clearance was  $\leq 1$  mm, an adverse outcome (endoscopic recurrence, tumor in the surgical specimen, or LNM) was present in 19.4%. By contrast, there were no adverse outcomes in low risk patients with margins  $> 1$  mm [249]. Resection margins of  $> 2$  mm are associated with very low rates of recurrence [251]. However the inclusion of a  $< 2$  mm margin as an unfavorable risk factor may result in overtreatment of lesions without other risk factors [255]. Unequivocal deep margin involvement is certainly an unfavorable risk factor and further resection is required, with the modality (sur-

gical resection or transanal endoscopic microsurgery [TEMS]) based on tumor location and patient co-morbidities. Clearance of  $\leq 1$  mm is associated with similar outcomes to definite margin involvement, and clearance  $> 1$  mm appears to be helpful in defining low risk patients. Other European guidelines currently recommend a level of  $\leq 1$  mm as equivalent to margin involvement [256, 257].

### 7.8 Combined risk assessment

Several risk factors have been established as high risk features for the prediction of LNM or residual disease in endoscopically resected lesions containing a malignant focus. These factors include deep submucosal invasion ( $> 1000 \mu\text{m}$  for flat or sessile lesions and Haggitt level 4 for pedunculated lesions), lymphovascular invasion, poor tumor differentiation, tumor budding, and a positive resection margin. Consequently, all these factors should be addressed in the pathology report in order to provide clinicians with a risk estimate for discussing further management in a multidisciplinary setting and with the patient [256]. The combination of risk factors is important, as an absence of defined high risk features has been shown to identify a “low risk group” of patients. Patients in this low risk group may still have a small risk of LNM and they should be followed as such.

## 8. Conclusion

This ESGE Guideline comprehensively addresses critical areas in the assessment and management of colorectal polyps. Polypectomy is among the most important colonoscopy skills. The ability to perform complete and safe polypectomy enables us to significantly benefit our patients. Mastery of basic polypectomy, and an understanding of the issues involved in advanced polypectomy, should be goals of all colonoscopists.

The diverse topics covered in this polypectomy and EMR Guideline include the classification of colorectal polyps, the optimal evidence-based approaches to polypectomy for polyps of all sizes and morphologies, colonic tattooing, a guide to effective and safe EMR for large sessile polyps, the role of advanced imaging in polypectomy, and which lesions require the involvement of expert centers or more complex interventions such as ESD or surgery. Technical aspects such as equipment and auxiliary devices to optimize polypectomy are also discussed. The Guideline defines the key adverse events during and following polypectomy, the recommended management of adverse events, and the need for audit of outcomes to monitor quality and safety of polypectomy and EMR. Finally, guidelines for the histological evaluation of resected polypectomy specimens and practice recommendations for high risk histological features are discussed. Throughout this Guideline, areas where further research is required to answer critical questions are highlighted, providing direction for researchers to design further studies. We look forward to the opportunity to incorporate the results of such studies into updates of this Guideline in the years to come.

ESGE guidelines represent a consensus of best practice based on the available evidence at the time of preparation. They may not apply in all situations and should be interpreted in the light of specific clinical situations and resource availability. Further controlled clinical studies may be needed to clarify aspects of the statements, and revision may be necessary as new data appear. Clinical consideration may justify a course of action at variance to these recommendations. ESGE guidelines are intended to be an educational device to provide information that may assist endoscopists in providing care to patients. They are not a set of rules and should not be construed as establishing a legal standard of care or as encouraging, advocating, requiring, or discouraging any particular treatment.

### Competing interests

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