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How “Dirty” Are the Endoscope Channels? A Systematic Review and Meta-Analysis of Reprocessed Endoscopes

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S988 Presidential Poster Award Winner

Risk Factors for Readmissions in Patients Undergoing Endoscopic Therapy for Peripancreatic Fluid Collections

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Introduction: Pancreatitis-related peripancreatic fluid collections (PPFCs) are associated with significant healthcare burden. Despite advancements in endoscopic therapy, recovery may be prolonged and require multiple hospital admissions. We evaluated the rate of unplanned readmissions, and risk factors for readmission, among patients undergoing endoscopic therapy for PPFCs.
Methods: We performed a retrospective study at a single academic medical center of patients undergoing cystogastrostomy with an electrocautery enhanced lumen apposing metal stent for PPFCs from June 2016 – May 2021. All patients had cross-sectional imaging reviewed by a single radiologist to characterize collections per the Revised Atlanta Classification for Acute Pancreatitis. Patient demographics, treatment data, and clinical course were obtained from review of the electronic medical record. Unplanned readmissions were defined as subsequent, unscheduled admissions following prior endoscopic therapy.
Results: Ninety-nine patients [60/61% walled off necrosis (WON) and 39/39% pseudocyst] underwent 414 endoscopic procedures. Post-index cystogastrostomy, patients had a mean of 3.2 (SD ±1.4) endoscopic interventions, including 16 (16%) with multi-transluminal gateway strategy and 26 (25%) with direct endoscopic necrosectomy. Eighteen patients had adjunct percutaneous drainage (18%). Clinical success was achieved in 83/88 (94%) patients with sufficient follow-up data available. Forty-two (14%) unplanned readmissions occurred over 300 encounters following index therapy. The most common reasons for readmission were sepsis (n=18; 43%), abdominal pain (n=10; 24%), gastrointestinal bleeding (n=5; 12%), and post-procedural observation (n=5; 12%). Twenty-two (52%) readmission events required endoscopic intervention. Factors associated with readmissions were antiplatelet therapy (60% vs. 10%, $P < 0.01$), nutritional support requirements (40% vs. 16%, $P < 0.01$), and index paracolic gutter extension (80% vs. 17%, $P < 0.01$). Multivariate regression analysis demonstrated paracolic gutter extension (OR 2.06 95% CI 1.15 - 3.86) as the only independent risk factor for readmission.
Conclusion: Unplanned readmissions are common in patients undergoing endoscopic drainage for peripancreatic fluid collections, with increased risk in those with paracolic gutter extension, antiplatelet use, or requiring nutritional support. Further investigation is needed to identify interventions that may reduce readmission rates.

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Mid-Term and Long-Term Outcomes of Peroral Endoscopic Myotomy for the Treatment of Achalasia: A Systematic Review and Meta-Analysis

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Introduction: Current evidence has shown that peroral endoscopic myotomy (POEM) had a satisfactory short-term clinical response in treatment of patients with achalasia. Data are limited on the long-term durability of POEM in achalasia patients. The aim of this study was to determine the mid-term and long-term outcomes of patients undergoing POEM.
Methods: We searched the Embase, Cochrane, and PubMed databases from inception to January 2021 using the designed search strategy. Data on technical and clinical success, adverse events, Eckardt score, lower esophageal sphincter (LES) pressure, and integrated relaxation pressure (IRP) were collected. The pooled event rates and mean differences (MD) were calculated.
Results: A total of 21 studies with 2,698 achalasia patients were included. Overall, the pooled technical success and adverse events rate of POEM were 98.6% (95% confidence interval [CI], 97.9% to 99.0%) and 16.3% (95% CI, 11.4 % to 22.8%). The pooled results of clinical success rates for 2-, 3-, 4-, and 5-year follow-ups were 90.9% (95% CI, 88.2% to 93.1%), 90.4% (95% CI, 88.1% to 92.2%), 89.8% (95% CI, 83.6% to 93.9%) and 82.2% (95% CI, 76.6% to 86.7%), respectively. During the follow-up, the mean Eckardt score was significantly decreased by 5.90 points (95% CI, 5.40 to 6.41; $p< 0.001$, $I^2=91\%$).
Conclusion: POEM is a highly safe and effective treatment for esophageal achalasia with favorable long-term outcomes.

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The Scientific Progresses and Prospects of Artificial Intelligence in Digestive Endoscopy: A Comprehensive Bibliometric Analysis

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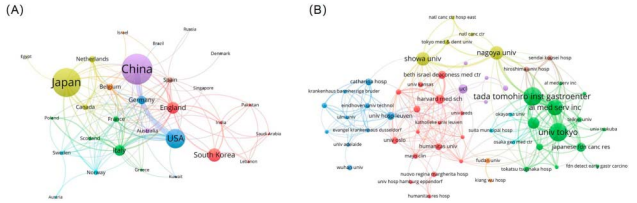
Introduction: A growing number of studies have reported artificial intelligence (AI) has been developed for diagnosis and outcome prediction in clinical practice. Furthermore, AI in digestive endoscopy has attracted much attention, which has shown promising and stimulating results. Our study aimed to visualize the articles to determine the trends and hotspots of AI in digestive endoscopy.
Methods: Publications on AI in digestive endoscopy research were retrieved from the Web of Science Core Collection (WoSCC) on March 14, 2021. Microsoft Excel 2016, VOSviewer 1.6.11.0, and CiteSpace V were used to assess and plot the research output.



[0990] **Figure 1.** Scientific influence of artificial intelligence in digestive endoscopy worldwide. (A) Network plot of influential countries among the publications of WoSCC. (B) Network plot of influential institutions among the publications of WoSCC.

Results: The analytic research was based on original articles and reviews. A total of 121 records of AI research in digestive endoscopy published from 2017 to 2021 were retrieved. The citation number for these articles ranged from 0 to 142. The number of published articles increased 68-fold just from 2017 to 2020. All publications were distributed among 31 countries and 296 institutions. Asian countries had the most publications in this field (80.17%). Among the 31 countries, China and Japan were consistently the leading driving force and contributed mostly (31.40% and 28.93%, respectively), with a strong academic reputation in this area. Tada Tomohiro distributed the most related articles (13.22%) and was cited the most frequently. Gastrointestinal endoscopy published the largest number of publications (14.88%), and 4 of the top 10 cited references were in this leading journal. "Barrett's esophagus" was the leading research hotspot. The keywords "classification," "polyps," "risk," "histology," and "resection" appeared most recently as research frontiers.
Conclusion: Our study provides a systematic elaboration for researchers to obtain a good comprehension of AI development in digestive endoscopy.

S991

How "Dirty" Are the Endoscope Channels? A Systematic Review and Meta-Analysis of Reprocessed Endoscopes

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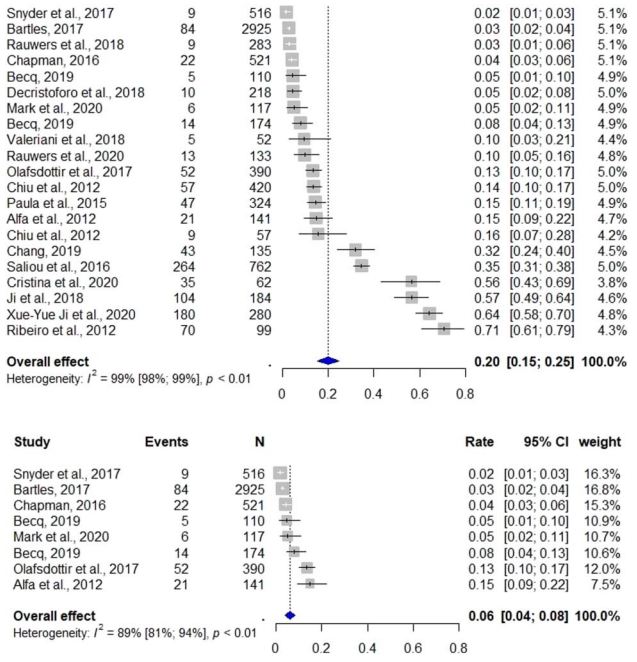
Introduction: The duodenoscope elevator mechanism has been considered a culprit for multiple outbreaks from contaminated reusable patient-ready duodenoscopes. These outbreaks necessitated FDA to issue various Safety Communications and recommend endoscopy units to transition to duodenoscopes with innovative designs that ease or eliminate reprocessing. However, numerous



[0991] **Figure 1.** 1a: Pooled estimates of contamination rates beyond the elevator. 1b: Pooled estimates of contamination rates beyond the elevator for studies conducted in North America. CI: confidence interval; EUS: Endoscopic ultrasound; prop: proportion.

studies have documented microbes in the channels of reprocessed gastrointestinal (GI) endoscopes, including duodenoscopes and linear echoendoscopes. Our aim is to estimate the channel contamination rate of patient-ready reprocessed GI endoscopes based on the currently available data.

Methods: We searched PubMed, Web of Science, and Embase from January 1, 2010, until October 10, 2020, for studies investigating contamination rates of channels of patient-ready flexible GI endoscopes by following the PRISMA guidelines. A random-effects model based on the proportion distribution was used to calculate pooled total contamination rate. A subgroup analysis was carried out for studies originating from North America (USA and Canada). We used the meta-package (*metafor*) in RStudio version 3.6.2 to conduct the statistical analyses. Heterogeneity between the included studies was analyzed using the inconsistency index (I^2) statistics. Publication bias was assessed using funnel plots and Egger's regression tests.

Results: We identified 1,230 peer-reviewed studies after duplicates were removed. Finally, 20 studies fulfilled the inclusion criteria, including 1,059 positive cultures from 7,903 samples. The total weighted contamination rate was 19.98% ± 0.024 (95% CI: 15.29%-24.68%; I^2=98.6%) (figure 1a). Subgroup analysis amongst studies from North America (n=7) showed a contamination rate of 6.01% ± 0.011 (95% CI: 3.88%-8.15%; I^2=89.3%) (figure 1b). I^2 indicated high heterogeneity. Egger's regression test indicated no significant publication bias for both groups (Egger's test of publication bias: p=0.0531 and p=0.0655).

Conclusion: Our analysis demonstrates that 19.98% of reprocessed patient-ready GI endoscopes may be contaminated. The contamination rate was lower amongst US studies, which may be attributed to the actions taken in the US to overcome this issue. However, our findings highlight that the elevator mechanism is not the only obstacle when reprocessing endoscopes. More studies are needed to fully determine the role of contaminated endoscope channels in the cross-transmission between the patients.

S992

Don't Blame the Duodenoscope Elevator, the Channels Are Contaminated as Well: A Systematic Review and Meta-Analysis

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Introduction: The elevator mechanism has been suggested as the main reason for multiple outbreaks associated with contaminated reusable patient-ready duodenoscopes. The elevator is difficult to clean even with all precautions, and specially designed brushes are recommended for proper cleaning. However, the narrow channels of the duodenoscope might pose a risk of contamination since they are prone to scratches by the insertion of various accessories creating space for microbes to hide. Our aim is to estimate the contamination rate beyond the elevator of duodenoscopes based on currently available literature.

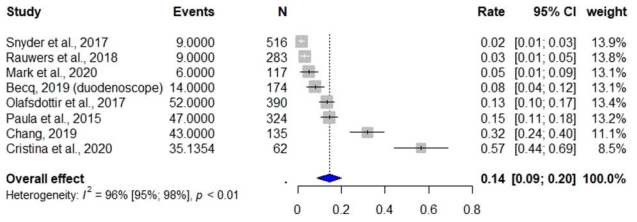
Methods: We searched PubMed, Web of Science, and Embase from January 1, 2010, until October 10, 2020, for studies investigating contamination rates of reprocessed duodenoscope channels and areas beyond the elevator. A random-effects model (REM) based on the proportion distribution was used to calculate the pooled total contamination rate beyond the elevator of reprocessed duodenoscopes. The meta-package (*metafor*) in RStudio version 3.6.2 was used to conduct the statistical analyses. Heterogeneity between the included studies was analyzed using the inconsistency index (I^2) statistics. Publication bias was assessed using the funnel plot and Egger's regression test.

Results: Eight studies including 215 positive cultures from 2,001 samples fulfilled the inclusion criteria. Four studies (50%) originated from the US, 3 studies (37.5%) originated from Europe (Italy, Netherlands, and Austria), and 1 study (12.5%) was conducted in Taiwan. See table 1 for baseline characteristics of the included studies. The total weighted contamination rate was 14.41% ± 0.029 (95% confidence interval [CI]: 8.70% - 20.13%), see figure 1. I^2 was 96.4% indicating high heterogeneity. Egger's regression test indicated no significant publication bias (Egger's test of publication bias: p=0.9919).

Conclusion: Our analysis indicates that 14.41% of reprocessed patient-ready duodenoscopes may be contaminated unrelated to the elevator. These findings highlight that the elevator mechanism is not the only part of the duodenoscope, which could remain contaminated even after reprocessing. Despite the role of contaminated channels has been studied, more evidence is needed to fully determine the consequences and potential link to patient-to-patient infections. Additionally, guidelines for disinfection units should recommend thorough surveillance of the endoscope channels to minimize endoscope-related infections.

[0992] **Table 1. Study characteristics of included studies.**

First author, year	Study design	Country	Sampled channels/areas	Positive cultures, n	Sample size, N	Type of microorganism
Snyder, 2017	Parallel group randomized study	USA	Working channel	9	516	N/A
Rauwers, 2018	Prospective nationwide cross-sectional study	Netherlands	Biopsy channel, suction channel	9	283	Yeasts, Moraxella spp., Klebsiella pneumoniae, Streptococcus salivarius, Enterobacter cloacae, Moraxella osloensis, Escherichia coli, Streptococcus mitis, Klebsiella oxytoca, Neisseria flavescens, Enterococcus faecium, Rothia spp., Enterococcus faecalis, Streptococcus mutans, Pseudomonas aeruginosa, Streptococcus oralis, Staphylococcus aureus, Streptococcus spp. Bacillus spp., Stenotrophomonas maltophilia, Micrococcus luteus, Acinetobacter spp., Staphylococcus epidermidis, Agrobacterium radiobacter, Kocuria spp., Paracoccus yeeii, Staphylococcus hominis, Achromobacter xylosoxidans, Staphylococcus warneri, Alternaria spp., Kocuria rhizophila, Pseudomonas monteilii, Micrococcus spp., Pseudomonas putida,Staphylococcus auricularis, Sphingomonas paucimobilis, Staphylococcus spp. (CNS), Rhizobium spp. Or Sphingobium spp.
Olafsdottir, 2017	Parallel group randomized study	USA	Working channel	52	390	N/A
Paula, 2015	Descriptive study	Austria	Air, water, suction, and biopsy channel	47	412	Unspecified skin bacteria and aerobe spore-forming bacilli
Mark, 2020	Descriptive study	USA	Working channel	6	117	Pseudomonas aeruginosa, fungal organisms, Staphylococcus aureus, Coagulase negative staphylococcus, Viridans streptococcus
Cristina, 2020	Descriptive study	Italy	Distal end, instrument channel	35	62	Pseudomonas aeruginosa, Klebsiella pneumoniae, Acinetobacter baumannii, Klebsiella oxytoca, Stenotrophomonas maltophilia, Escherichia coli, Citrobacter freundii, Enterobacter spp
Chang, 2019	Descriptive study	Taiwan	Distal end outer surface, distal attachment cap, elevator wire channel, suction biopsy channel	43	135	N/A
Becq, 2019	Prospective single-center study	USA	Working channel	14	174	N/A



[0992] **Figure 1.** Pooled estimates of contamination rates beyond the elevator of patient-ready duodenoscope. CI: confidence interval; prop: proportion.

S993

Continued Aspirin Use and Bleeding Risk After Endoscopic Submucosal Dissection of Gastric Neoplasms: A Meta-Analysis

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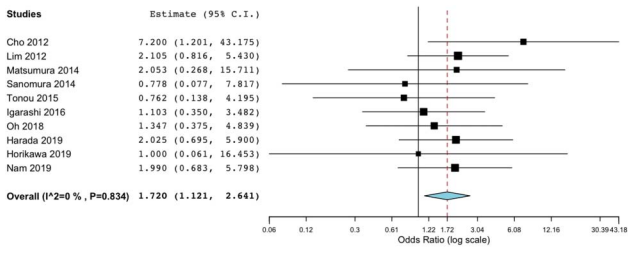
Introduction: With the development of endoscopic technologies, the detection rate of early gastric cancer (EGC) and precancerous lesions is gradually increasing. As an effective minimally invasive therapy, endoscopic submucosal dissection (ESD) has been accepted as a standard treatment for EGC and dysplasia. However, postprocedural bleeding is one of the most common complications of ESD, with a reported incidence of 5.1%. Moreover, the effect of continued low-dose aspirin (LDA) on bleeding during the peri-ESD period is not clear.

Methods: We searched the OVID/Medline and Google Scholar databases through June 2021 to find studies relating to continued LDA use in patients undergoing ESD. Studies reporting bleeding rates in patients undergoing ESD with and without continued LDA were included. Postoperative bleeding rates were compared between those who continued LDA during the procedure and those who did not; a random-effects model was used to calculate pooled odds ratio for bleeding risk with continued LDA use. A p-value < 0.05 was considered statistically significant.

Results: The initial search identified 2023 studies; after excluding duplicates, review articles, and studies not meeting inclusion criteria, 9 studies (all were retrospective observational studies) were finally included in the analysis. The total number of patients undergoing ESD procedure was 7978, out of which 703 continued LDA during the procedure. Pooled analysis comparing the post-operative bleeding rates between people with and without continued use of LDA revealed that aspirin use during ESD translated into higher postoperative bleeding rates compared to those who did not. (Pooled OR 1.720 , 95%CI: 1.121-2.641, P= 0.01). No interstudy heterogeneity was observed (I^2=0).



[0993] **Figure 1.** Forest plot of gastric neoplasm studies with and without continuation of low-dose aspirin.