Medtronic

Stapling Evidence

Enter

SECTION 1

Powered Stapling vs Manual stapling

Select

SECTION 2

Buttress Colorectal

Select

SECTION 3

Environmental Impact

Select

Acronyms

Medtronic

Acronyms

AB	Anastomotic bleeding
AL	Anastomotic leak
CS	Circular staplers
DCS	double-row circular stapler
LVRS	lung volume reduction
MCS	Two-row manual circular stapler
MUS	Multi-Use Surgical Staplers
NR	Not Reported
NSCLC	non-small cell lung cancer
PCS	Powered circular stapler
PGA	polyglycolic acid
PSW	Propensity score weighting
pts	Patients
RCT	Randomized controlled trial
SUS	Single-Use Stapler
TCS	triple-row circular stapler
TRCS	Three-row manual circular stapler
VATS	video-assisted thoracoscopic surgery

SECTION 1

Clinical advantages of powered stapling vs manual stapling

Articles (conclusions)	Tissue	Staplers	
Martín-Arévalo J, et al. 2024 Powered circular stapler presented a significantly lower risk of leakage and anastomotic bleeding while Three-row manual circular stapler only demonstrated a risk reduction in Anastomotic leak (AL). Risk difference of AL was superior in the Powered circular stapler than in Three-row manual circular stapler.	Colorectal	Two-row manual circular stapler Three-row manual circular stapler Powered circular stapler	PubMed link
McKechnie T, et al. 2024 Triple-row staple technology may reduce the risk of anastomotic leak in left-sided colorectal anastomoses.	Colorectal	Tri-staple Technology with EEA circular staplers (Medtronic) Tri-staple Technology with the Endo GIA articulating reload (Medtronic) 2-row circular staplers Medtronic Endo GIA Universal Straight Reload (Medtronic)	PubMed link
Vanstraelen S, et al. 2023 The introduction of a powered circular stapler contributed to an 80% risk reduction of anastomotic leakage after esophageal resection for cancer with intrathoracic anastomoses in a propensity score matched monocentric observational series. This consequently, resulted in a reduced length of stay.	Esophagogastric	Manual: EEA™ Circular Stapler (Medtronic) Powered: Echelon Circular™ Powered Stapler (Ethicon)	PubMed link
Wang T, et al. 2023 The risk of AL observed with manual two-row circular staplers was similar to that seen with three-row devices. This study affirms the safety of manual two-row circular staplers in colorectal anastomosis.	Colorectal	Ethicon manual circular staplers Medtronic EEA™ circular stapler with DST ™ technology Medtronic EEA™ circular stapler with Tri-Staple™ technology	PubMed link
Gan C, et al. 2022 Gripping Surface Technology (GST) system was associated with better intraoperative outcomes in clinical practice in China	Lung	Echelon Flex GST powered staplers manual: NR	PubMed link

SECTION 1

Clinical advantages of powered stapling vs manual stapling

Articles (conclusions)	Tissue	Staplers	
Quero G. et al. 2022 Three-row CSs significantly decrease the rate of AL after rectal resection. Further multicenter controlled trials are still needed to confirm the advantages of three-row CSs on anastomotic complications.	Colorectal	Two-row circular stapler: ETHICON™ Circular Stapler (Ethicon) - DST Series EEA (Medtronic) Three-row circular stapler: Tri-staple™ Technology (Medtronic)	PubMed link
McKinnon C. et al. 2022 The Medtronic I-Drive and the Ethicon Echelon are comparable in reload time, stapler misfires, leak test rates, and cost.	Gastrointestinal	Medtronic I-Drive powered stapler with EndoGIA reinforcement arms Ethicon Echelon powered stapler with Seamguard	PubMed link
Shigeeda W. et al. 2021 Using a powered stapler to divide the incomplete interlobular fissure decreased the need for additional intraoperative management using fibrin glue and reduced postoperative air leakage in radical pulmonary resection	Lung	Powered stapler: Signia™ stapling system (Medtronic) Manual stapler: ENDO GIA™ Ultra Universal Stapler (Medtronic) Reinforcement: Endo GIA™ Reinforced Reload with Tri-Staple™ technology (Medtronic)	PubMed link
Akil A. et al. 2019 The iDrive powered stapling system offers one-handed, push-button operation, which eliminates the manual firing force and possibly enables more precise resection. In the current study, the novel system led to comparable results with the conventional mechanical stapler without any disadvantages in patients undergoing bilateral VATS-LVRS.	Lung	Powered: iDrive powered stapling system (Medtronic) Manual: EndoGIA (Medtronic)	PubMed link

SECTION 1

Clinical advantages of powered stapling vs manual stapling

Articles (conclusions)	Tissue	Stapler	
Mazaki J. et al. 2022 Propensity score-matched analysis of clinical data suggested that the use of TCS contributes to a reduced risk of AL after colorectal anastomosis with the double stapling technique	Colorectal	EEA™ circular stapler with Tri-Staple™ technology Double-row circular stapler	PubMed link
Nakanishi R et al. 2021 Anastomoses created using a triple-layered circular stapler had high bursting pressure, which might contribute to a lower incidence of anastomotic leakage after rectal cancer surgery.	Colorectal	Double- or triple-layered circular stapler	PubMed link

SECTION 1

Clinical advantages of powered stapling vs manual stapling

Other suggested readings

	Study type	
EE145 Cost-Effectiveness Analysis of the Novel Powered Circular Stapler in Colorectal Anastomosis Surgery González de Julián S. et al. 2022 Value in Health (2022) 25:12 Supplement (S81)	Cost-effectiveness study	PubMed link
Indirect comparison between powered and manual circular staplers for left-sided colorectal anastomoses: clinical and economic outcomes in China Bai J. et al. 2022 Cost Effectiveness and Resource Allocation (2022) 20:1 Article Number: 45	Decision analysis model	PubMed link
Economic analysis of leak complications in anastomoses performed with powered versus manual circular staplers in left-sided colorectal resections: A us-based cost analysis Pollack E. et al. 2021 ClinicoEconomics and Outcomes Research (2021) 13 (531-540).	Budget impact model	PubMed link
A Novel Predictive Model for Anastomotic Leakage in Colorectal Cancer Using Auto-artificial Intelligence Mazaki J et al 2021 Anticancer Res. 2021;41(11):5821-5825	Efficacy using AI model	PubMed link
Comparison of pressure resistance of double-rows and triple-rows circular stapler in rectal double stapling technique: In vitro study. Mazaki J et al 2022 Medicine (Baltimore). 2022;101(28):e29600	Pre-clinical study	PubMed link
Evaluating Performance of Circular Staplers Using Comparative Test Methods for Evidence-Based Surgery Strassner H. et al. 2023 Surg Innov. 2023;30(5):576-585	Pre-clinical study	PubMed link

Powered stapling vs manual stapling

Two-row, three-row or powered circular stapler, which to choose when performing colorectal anastomosis? A systematic review and meta-analysis

Martín-Arévalo J. et al.

Int J Colorectal Dis. 2024;39(1):51

The *objective* is to provide the existing evidence on which of these circular staplers would have a lower risk of presenting a leak and/or anastomotic bleeding.

Meta-analysis
7 articles

A)
Two-row manual circular stapler (MCS): 2103 cases
Powered circular stapler (PCS): 844 cases

B)
Three-row manual circular stapler (TRCS): 1965 cases (10.65%)
Two-row manual circular stapler (MCS): 16.490 cases (89.35%)

Indication: colorectal

Results

- *Anastomotic bleeding*

138/2200 pts (6.27%)

PCS: 5 (0.96%)
MCS: 133 (7.91%)

Common-effect model:
OR: 0.19 (95% CI: 0.07–0.048)

Random-effect model:
0.2 (95% CI: 0.08–0.52) I2 0.0%, Q: 1.29, p = 0.526
results suggest a protective effect of PCS

Risk:− 0.03 (95% CI: − 0.07 to − 0.01) I2 87%
PCS needed to avoid bleeding would be 34 cases

- *Anastomotic leakage/air leakage incidence*

A) 208/2947pts
PCS: 35 (4.1%)
MCS: 173 (8.23%)
(p < 0.001)

Common-effect model:
OR: 0.3695 (95%-CI: 0.247–0.553)

Random-effect model:
OR: 0.402 (0.266–0.608) I2 0.0%, H2 0.91
results suggest a protective effect of PCS

Risk: − 0.06 (95% CI: − 0.07 to − 0.04) I2 0%
significantly decreased risk of PCS use
The number of patients needed to treat with PCS to avoid leakage would be 17.

B) 1631/16.490 pts
TRCS: 123 (6.26%, 1.8–8.19%)
MCS: 1508 (9.14%, 6.12–11.6%)

Random-effect model:
0.446 (95%-CI: 0.217 to 0.916) I2 75.1%, Q = 12.05, p = 0.007
results suggest a protective effect of PCS

Risk: - 0.04 (95%-CI: − 0.04 to − 0.08)
suggests a significantly decreased risk of TRCS
The number of patients needed to treat with TRCS to avoid leakage would be 24.

Insight

- **Powered circular stapler** could have a **significantly lower risk of leakage and anastomotic bleeding** than a two-row manual circular stapler.
- The **three-row circular stapler** may also have a **reduced risk of anastomotic leakage** compared with the two-row manual circular stapler.
- The reduction of the risk of anastomotic leakage could be greater in the powered circular stapler group than in the three-row circular stapler group.

Acronyms

PubMed link

Powered stapling
vs
manual stapling

Double-row staple technology versus triple-row staple technology for colorectal surgery: A systematic review and meta-analysis

Tyler McKechnie et al.

Surgery 176 (2024) 633e644

The *objective* is to compare double- and triple-row staple technology for colorectal anastomoses

Meta-analysis
6 articles

Double-row staple: 19.372
Triple-row staple: 2.298

Indication: colorectal surgery

Tri-staple Technology with EEA circular staplers (tri-EEA) (Medtronic)
Tri-staple Technology with the Endo GIA articulating reload (Medtronic)

2-row circular staplers
Medtronic Endo GIA Universal Straight Reload (Medtronic)

Results

- *Anastomotic bleeding*

Triple-row stapler vs double-row stapler
1.2% vs 3.9%, RR 0.47, 95% CI 0.15-1.49, P: .20, I2: 57%

- *Anastomotic leakage/air leakage incidence*

Pooled analysis
Significantly reduced with triple-row staple technology (6.3% vs 7.5%, RR: 0.54, 95% CI 0.31-0.94, P:.03, I2: 75%)

Sensitivity analysis
Significant reduction with triple-row staple technology (3.4% vs 5.9%, RR 0.55, 95% CI 0.36 - 0.85, P: .01, I2: 4%)*
*exclusion of articles with conflict of interest and non-circular staplers

Findings no longer statistically significant (6.4% vs 7.4%, RR 0.65, 95% CI 0.39 -1.09, P: .10, I2: 64%)**
**exclusion of non-circular staplers

Significant reduction with triple-row staple technology (3.7% vs 6.6%, RR 0.47, 95% CI 0.31 - 0.70, P < .01, I2: 17%)***
***exclusion of articles with conflict of interest

- *Length of hospital stay*

Mean: 0.80 days less in the triple-row
(95% CI -3.59 to 1.99 days, P: .57, I2: 98%)

- *Operation time*

(95% CI -25.80 to 39.61 minutes, P: .68, I2: 76%)
Mean difference of 6.91 minutes favoring double-row staple

Insight

- **Triple-row staple technology** was associated with a **significant reduction** in anastomotic leak risk
- Mortality and reoperation showed no significant difference

Acronyms

PubMed link

Powered stapling
vs
manual stapling

Real-life introduction of powered circular stapler for esophagogastric anastomosis: cohort and propensity matched score study

Vanstraelen S. et al.

Dis Esophagus. 2023;36(5):doac073

The *objective* is to evaluate the impact of a powered circular stapler on complications after esophagectomy with intrathoracic anastomosis for esophageal cancer.

Retrospective study

128 pts
Powered: 62
Manual: 66

Propensity score matched cohort
Powered: 49
Manual: 49

Indication Esophagectomy

Manual: EEA™ Circular Stapler (Medtronic)
Powered: Echelon Circular™ Powered Stapler (Ethicon)

Results

- *Anastomotic leakage/air leakage incidence*

Manual: 13/66 (19.7%)
Powered: 2/62 (3.2%)
p=0.004

Relative risk reduction: 83%
OR: 7.3 (95% confidence interval [CI]: 1.58–33.74).

Propensity score matched
Manual: 10 (20.4%)
Powered: 2 (4.1%)
p: 0.013

- *Length of hospital stay*

Mean
Manual: 18.3
Powered: 11.9
p: 0.026

Manual: 18.7
Powered: 11.1
p: 0.022

- *Adverse Events*

90-day mortality
Manual: 4 (6.1%)
Powered: 1 (1.6%)
p: 0.366

Comprehensive Complication
Manual: 33.8
Powered: 23.0
P: 0.005

Insight

- **Powered circular stapler** contributed to an 80% **risk reduction of anastomotic leakage** after esophageal resection for cancer with intrathoracic anastomoses in a propensity score matched analysis.
- This consequently, resulted in a **reduced** length of stay

Acronyms

PubMed link

Powered stapling vs manual stapling

Risk of anastomotic leakage with two-row versus three-row manual circular staplers in colorectal anastomosis: a U.S. cohort study

Wang T. et al.

Int J Colorectal Dis. 2023;38(1):264

The *objective* is to compare the risk of anastomotic leak (AL) between Ethicon manual circular staplers (two-row) versus Medtronic EEA™ circular stapler with Tri-Staple™ technology (three-row) and between Medtronic EEA™ circular stapler with DST™ Series technology (two-row) versus Tri-Staple™ technology

Retrospective study

Ethicon manual circular staplers: 8337
Medtronic EEA™ circular stapler with DST™ technology: 7928
Medtronic EEA™ circular stapler with Tri-Staple™ technology: 1306

Indication: Left-sided colorectal surgery

Results

- *Anastomotic leakage/air leakage incidence*

Ethicon manual circular staplers vs. Medtronic EEA™ circular stapler with Tri-Staple™ technology
RR: 0.72; 95% CI, 0.52–1.01

Medtronic EEA™ circular stapler with DST™ technology vs. Medtronic EEA™ circular stapler with Tri-Staple™ technology
RR, 0.75; 95% CI, 0.53–1.06

Insight

- The **risk of AL** observed with manual two-row circular staplers was **similar** to that seen with three-row devices, after PSW.
- Similar results were found for patients who did not have a diverting stoma prior to or on the same day as a left-sided colorectal surgery during the index admission.
- **Two-row manual circular staplers** are **safe** for colorectal anastomosis

Acronyms

PubMed link

Powered stapling
vs
manual stapling

Powered stapling system with gripping surface technology for pulmonary resection of lung cancer: real-world clinical effectiveness

Gan C. et a.

Cost Eff Resour Alloc. 2022;20(1):72

The *objective* is to examine the real-world effectiveness of Gripping Surface Technology system on intraoperative and postoperative outcomes of pulmonary resection

Retrospective study
108 pts
Powered: 54
Manual: 54

Indication: Surgical lung resection

Echelon Flex GST powered staplers

Manual: NR

Results

- *Anastomotic leakage/air leakage incidence*

No bubble
Powered: 48 (88.9%)
manual: 46 (85.2%)
p 0.556

Countable bubble
Powered: 5 (9.3%)
Manual: 8 (14.8%)

- *Length of hospital stay*

Powered: 7.78 ± 2.72
Manual: 7.71 ± 2.38
p 0.877

- *Operation time*

Powered: 118.04 ± 37.39
Manual: 127.06 ± 46.22
p 0.281

- *Intraoperative bleeding*

Powered: 22.8%
Manual: 51.9%
p = 0.003

- *Use of NEOVEIL* (reinforcement material to prevent air leakage from the staple line) *intraoperatively*

Powered: 24.1%
Manual: 50%
p = 0.01

Insight

- **GST system** is associated with better intraoperative outcomes, such as **reduced** bleeding and intervention rates.

Acronyms

PubMed link

Powered stapling
vs
manual stapling

Preliminary evaluation of two-row versus three-row circular staplers for colorectal anastomosis after rectal resection: a single-center retrospective analysis

Quero G. et al.

Int J Colorectal Dis. 2022;37(12):2501-2510

The *objective* is to evaluate potential advantages of three-row circular staplers (Three-CS) on anastomotic leakage (AL), stenosis (AS), and hemorrhage (AH) rates after rectal resection as compared to two-row circular staplers (Two-CS).

Retrospective study
375 pts
two-row circular: 197 (52.5%)
three-row circular: 178 (47.5%)

Indication: Rectal resection

Two-row circular stapler: ETHICON™ Circular Stapler (Ethicon) - DST Series EEA (Medtronic)
Three-row circular stapler: Tri-staple™ Technology (Medtronic)

Results

- *Anastomotic bleeding*

two-CS: 3 (1.5)
three-CS: 2 (1.1)
p 0.73

- *Anastomotic leakage/air leakage incidence*

two-row CS: 19 (9.6)
three-row CS: 6 (3.4)
p 0.01

AL onset was significantly associated to:
BMI ≥ 25 (p = 0.05)
tumor lesions located in the middle/low rectum (p < 0.0001)
Two-CS (p = 0.01)

Multivariate analysis
Tumor location in the middle/low rectum OR: 4 [95% CI: 1.64–9.87] p = 0.002)
Two-CS OR: 2.63 [1.07–6.46]p = 0.03
Independent prognostic factors

<u>Subanalysis on patients with low rectal cancer</u>
46 patients
Two-CS: 24 (52.2%)
Three-CS: 22 (47.8%)
p = 0.95

- *Length of hospital stay*

two-row CS: 8 (6–11)
three-row CS: 5 (4–6)
p < 0.0001

- *Surgical approach minimally invasive procedures*

Three-CS group: 170–95.5%
Two-CS: 141–71.5%
p < 0.0001

- *Anastomotic stenosis*

two-row CS: 1 (0.5)
three-row CS: 1 (0.6)
p 0.94

- *in-hospital mortality*

Two-row CS: 1 (0.5)
Three-row-CS: 0
p 0.34

Insight

- **Less** anastomotic leakage incidence when the **Three-CS** was employed
- The **type of circular stapler did not show any influence** on anastomotic leakage severity
- Furthermore, the **Two-CS** and **Three-CS** were **comparable** for anastomotic bleeding and anastomotic stenosis rate

Acronyms

PubMed link

Powered stapling vs manual stapling

Medtronic I-Drive vs Ethicon Echelon: A Head-to-head Randomized Controlled Trial

McKinnon C. et al.

World J Lap Surg 2022; 15 (1):65-68

The *objective* is to compere Echelon with Seamguard (ESG) or I-Drive with EndoGIA reinforcement arms (GIA-R) in sleeve gastrectomies.

Randomized controlled trial (RCT)
63 pts
i-Drive: 25
Ethicon: 26

Indications: laparoscopic sleeve gastrectomies

Medtronic I-Drive powered stapler with EndoGIA reinforcement arms
Ethicon Echelon powered stapler with Seamguard

Results

- *Anastomotic bleeding*

GIA-R system: 15.63
Echelon: 34.38%
p = 0.44

- *Operation time*

Sleeve creation time (minutes)
Echelon: 12.14
GIA-R system: 14.26
P=0.04
Time to reload (seconds)
Echelon: 41.77
GIA-R system: 39.78
P=0.42

- *Economic outcomes*

Stapler cost (Government rate)
Echelon: $2,449.44
GIA-R system: $2,097.66
P=0.0002
Stapler cost (Commercial rate)
Echelon: $1,982.17
GIA-R system: $2,037.25
P=0.48

- *Stapler loads used*

Echelon: mean of 5.38
GIA-R arm: mean of 4.92
p = 0.052

- *Stapler misfires*

GIA-R system: 3
Echelon: 1

Insight

- **Echelon with Seamguard** (ESG) or **I-Drive with EndoGIA reinforcement** arms (GIA-R) were found to be **comparable** regarding reload time, misfires, leak rates, and overall cost when considering commercial pricing.

Acronyms

PubMed link

Powered stapling vs manual stapling

Utility of the powered stapler for radical pulmonary resection: a propensity score-matched analysis

Shigeeda W. et al.

Surgery Today (2021) 51:4 (582-588)

The *objective* is to compare the utility of a powered stapler with that of a manual stapler, using the same cartridge, for pulmonary resection.

Retrospective study
478 pts

Powered: 179
Manual: 269

Propensity score analysis
Powered: 98.9% (177/179)
Manual: 65.8% (177/269)

Indication: Radical pulmonary resection

Powered stapler: Signia™ stapling system (Medtronic)

Manual stapler: ENDO GIA™ Ultra Universal Stapler (Medtronic)

Reinforcement: Endo GIA™ Reinforced Reload with Tri-Staple™ technology (Medtronic)

Results

- *Anastomotic leakage/air leakage incidence*

Powered: 2.8%
Manual: 8.6%
p = 0.014

Propensity score analysis
Powered: 2.8%
Manual: 10.7%
p = 0.003

- *Length of hospital stay*

Powered: 8.5 ± 4.0 days
Manual: 11.6 ± 17.9 days
p = 0.023

Propensity score analysis
Powered: 8.5 ± 4.0 days
Manual: 12.2 ± 21.27 days
p = 0.026

- *Operation time*

no significant differences

Duration of chest tube placement
Powered: 4.5 ± 1.7 days
Manual: 5.1 ± 3.1 days
p = 0.011

Propensity score analysis
Duration of chest tube placement
Powered: 4.5 ± 1.7 days
Manual: 5.3 ± 3.6 days
p = 0.006

- *Economic outcomes*

Respective average costs, those for the powered-stapler group were significantly less than those for the manual-stapler group (JPY 2,102,090 ± 21,894.5 vs. 2,260,660 ± 76,199.1, p = 0.046).

Insight

- **Powered staplers** are associated with **decreased** fibrin glue usage and **reduced** air leakage, as well as **shorter** chest tube placement and hospital stays.
- **Powered staplers** offer advantages in pulmonary procedures, potentially leading to **improved** patient outcomes and cost savings

Acronyms

PubMed link

Powered stapling
vs
manual stapling

Use of a Powered Stapling System for Minimally Invasive Lung Volume Reduction Surgery: Results of a Prospective Double-Blind Single-Center Randomized Trial

Akil A. et al.

Thoracic and Cardiovascular Surgeon (2019) 67:3 (216-221)

The *objective* is to test iDrive powered stapling system during video-assisted thoracoscopic surgery (VATS) for lung volume reduction (LVRS) and compare with a non-electronic conventional device

Prospective, randomized trial
40 pts

Intrapatient control

Indication: advanced lung emphysema

Powered: iDrive powered stapling system (Medtronic)
Manual: EndoGIA (Medtronic)

Results

- *Anastomotic leakage/air leakage incidence*

iDrive-group: 230 +- 81 (0–2,300)
EndoGIA-group: 321 +- 116 (0–3,400)
p = 0.6

Day1
iDrive-group: 308 +- 94 (0–2,200)
EndoGIA-group: 255 +- 95 (0–2,300)
p = 0.7

- *Operation time*

iDrive-group: 52 +- 2.5 (29–93)
EndoGIA-group: 54 +- 3.8 (21–105)
p = 0.5

Insight

- **iDrive system** performed comparably to the conventional stapler, showing **no** significant **differences** in surgical duration, air leakage, or length of chest tube therapy.

Acronyms

PubMed link

Powered stapling
vs
manual stapling

Effectiveness of a new triple-row circular stapler in reducing the risk of colorectal anastomotic leakage: A historical control and propensity score-matched study

Junichi Mazaki et al.

Medicine (Baltimore). 2022;101(27):e29325

The *objective* is to evaluate the effectiveness of the EEA™ circular stapler, a new triple-row circular stapler (TCS), relative to a conventional, double-row circular stapler (DCS).

Retrospective study
285 pts

Double-row CS: 202
Triple-row CS: 83

Propensity score matching
1:2
112:56

Indication: Colorectal cancer

EEA™ circular stapler with Tri-Staple™ technology

Double-row circular stapler

Results

- *Anastomotic leakage/air leakage incidence*

17/285 (6.0%)

DCS: 15 (7.4%)
TCS: 2 (2.4%)
p: 0.17

Case matching
DCS: 13 (11.6%)
TCS: 1 (1.8%)
p: 0.04

- *Diverting stoma*

AL after case matching, there were 6 patients in the DCS group (46%) and no patients in the TCS group (0%)

Insight

- **EEA™ circular stapler with Tri-Staple™ technology** is associated with a **significantly lower risk** of anastomotic leak compared to the DCS

Acronyms

PubMed link

Powered stapling
vs
manual stapling

Clinical impact of the triple-layered circular stapler for reducing the anastomotic leakage in rectal cancer surgery: Porcine model and Multicenter retrospective cohort analysis

Nakanishi R. et al.

Ann Gastroenterol Surg. 2021;6(2):256-264

The *objective* is to investigate the impact of the triple-layered circular stapler compared with the double-layered circular stapler on anastomotic leakage after rectal cancer surgery.

Retrospective study
194 pts

Double-layered: 153
Triple-layered: 41

Indication: rectal cancer

EEA™ Circular Stapler with Tri-Staple™ Technology (tri-EEA)
EEA™ Circular Stapler with DST Series™ Technology (EEA)

Results

- *Anastomotic leakage/air leakage incidence*

triple-layered stapler: 0.0%
double-layered stapler: 5.8%
P = .0362

- *Length of hospital stay*

EEA group: 14 days
tri-EEA: 4 days
P =.4757

- *Operation time*

EEA: 227 min
tri-EEA: 278 min
p=0.0042

- *Multivariate analysis factors independently associated with a lower incidence of anastomotic leakage*

triple-layered vs stapler usage
OR 0.00, 95% confidence interval: 0.00-0.96, P = .0465

- *Postoperative complications*

(CD grade ≥3)
EEA group: 8%
tri-EEA: 2%
P =.1731

Insight

- Anastomoses created using a **triple-layered circular stapler** had high bursting pressure, which might contribute to a lower incidence of anastomotic leakage after rectal cancer surgery.

Acronyms

PubMed link

SECTION 2

Buttress reload use for colorectal

Article (conclusions)	Tissue	Stapler	
Gerbasi LS. et al. 2024 Tri-Staple™ reduces the risk of leakage in colorectal anastomosis. However, this study provides only insights, and further research is warranted to confirm these findings.	Colorectal tract	DST™ Series technology (Medtronic) circular stapler EEA Tri-Staple™ (Medtronic) circular stapler	PubMed link
Mori S. et al. 2024 The simple technique for constructing a sutureless overlapped anastomosis using a 60 mm linear stapler with a reinforced bioabsorbable material in robotic right colectomy with intracorporeal anastomosis appears to be safe and feasible.	Colorectal tract	Signia Stapling Technology; Endo GIA 60 mm Articulating Medium Thick Reload with Tri-StapleTM Technology (Medtronic)	PubMed link
Shibutani M. et al. 2023 Double-stapling technique anastomosis with PGA sheet, which is easy to perform, contributes to the reduction of anastomotic leakage rate by increasing the strength of the anastomotic site.	Colorectal tract	PGA: Neoveil	PubMed link
Hokonohara K. et al. 2022 The overlapped delta-shaped anastomosis technique using linear staplers with reinforced bioabsorbable material appears to be both safe and feasible.	Colorectal tract	Endo GIA 60 mm Articulating Medium Thick Reload with Tri-Staple Technology (Medtronic)	PubMed link
Shibutani M. et al. 2021 A PGA sheet may be effective for preventing anastomotic leakage in double-stapling technique anastomosis for rectal surgery.	Colorectal tract	PGA: Neoveil	PubMed link
Naito M. et al. 2017 The automatic PGA-felt suture device is safe and effective for colorectal resections and anastomoses	Colorectal tract	PGA: Neoveil Endo GIA Reinforced Reload with Tri-Staple Technology DST Series EEA Stapler (Medtronic)	PubMed link

SECTION 2

Buttress reload use

Article (conclusions)	Tissue	Stapler	
Deguchi H et al. 2020 Using the stapler with PGA to divide the incomplete interlobular fissure in pulmonary lobectomy reduced postoperative air leakage and decreased the need for additional intraoperative management using fibrin glue.	Lung	PGA: Neoveil and Gunze	PubMed link
Khandhar S.J. et al. 2024 The two-row stapler reloads demonstrated favorable safety and efficacy profiles when fired across hilar vessels in the thoracic space with a 99% hemostatic rate, independent of surgical access and stapler handle preference.	Lung	Signia™ Small Diameter Reloads	PubMed link

Buttress reload use for colorectal

A sutureless overlapped anastomosis technique using linear staplers with reinforced bioabsorbable material in robotic right colectomy with intracorporeal anastomosis

Mori S. et al.

Colorectal Disease (2024) 26:4 (754-759)

The *objective* is to present a simple method for constructing a sutureless overlapped anastomosis using a 60 mm linear stapler with a reinforced bioabsorbable material in RRC with intracorpareal anastomosis.

Technical study
10 pts

Indication: Robotic right colectomy (RRC) tumours of the caecum

Signia Stapling Technology; Endo GIA 60 mm Articulating Medium Thick Reload with Tri-StapleTM Technology (Medtronic)

Results

- *Length of hospital stay*
10 days (range 8–15 days)

- *Operation time*
Median
281 min (range 228–459 min)

- *Anastomosis construction time*
12 min (range 11–17 min)

- *Intraoperative adverse events*
No

Insight

- **Sutureless technique** appears safe and feasible, offering a potentially faster alternative to traditional handsewn methods for creating anastomosis during RRC with IA

Acronyms

PubMed link

Buttress reload use for colorectal

Efficacy of the polyglycolic acid sheet for preventing anastomotic leakage in double-stapling technique anastomosis for left-sided colon or rectal cancer surgery: a propensity score-matched study

Shibutani M. et al.

BMC surgery (2023) 23:1 (135)

The *objective* is to evaluate the effect of the PGA sheet on preventing anastomotic leakage in patients with left-sided colorectal cancer who underwent DST anastomosis

Retrospective study
356
PGA: 43 pts
Control: 313 pts

Indication: Left-sided colorectal cancer

PGA: Neoveil

Results

- *Anastomotic bleeding*

PGA: None
Control: 5 (1.6%)
No statistical difference

Propensity score matching
PGA: 0 (0%)
Control: 0 (0%)
p NA

- *Anastomotic leakage/air leakage incidence*

PGA: 1 (2.3%)
Control: 42 (13.4%)
p = 0.042

Propensity score matching
PGA: 1/43 (2.3%)
Control: 8/43 (18.6%)
p = 0.030

- *Re-operation*

PGA: None
Control: 2.6%
p = 0.603

Propensity score matching
PGA: 0/43 (0%)
Control: 1/43 (2.3%)
p > 0.999

Insight

- **PGA sheet** is an easy-to-perform and cost-effective method to strengthen the anastomosis site and reduce the risk of this common and serious surgical complication

Acronyms

PubMed link

Buttress reload use for colorectal

A new overlapped delta-shaped anastomosis technique using linear staplers with reinforced bioabsorbable material for intracorporeal anastomosis during laparoscopic colectomy

Hokonohara K. et al.

Colorectal Disease (2022) 24:11 (1427-1429)

The *objective* is to evaluate a construction technique for an overlapped delta-shaped anastomosis using a linear stapler with a reinforced bioabsorbable material.

Technical study
5

Indication: laparoscopic colectomy with intracorporeal anastomosis
Colon tumor

Endo GIA 60 mm
Articulating Medium Thick Reload with Tri-Staple Technology (Medtronic)

Results

- *Length of hospital stay*
12 days (range 9–15 days)

- *Operation time*
Median 329 min (range 285–682 min)

- *Anastomosis construction time*
19 min (range 14–29 min)

- *Perioperative complications*
No

Insight

- The aim of this technique is to minimize surgical trauma and wound complications compared to traditional methods.

- The results show the **feasibility** and **safety** of the new approach in a small group of patients, suggesting it could lead to quicker recovery and better outcomes.

Acronyms

PubMed link

Buttress reload use for colorectal

Prevention of anastomotic leakage using a polyglycolic acid sheet in double-stapling technique anastomosis for rectal surgery

Shibutani M. et al.

Ann Med Surg (Lond). 2021;72:103117

The *objective* is to examine whether or not a polyglycolic acid (PGA) sheet is effective for reinforcing rectal anastomosis.

Retrospective study
15 pts

Indication: Rectal surgery

PGA: Neoveil

Results

- *Anastomotic leakage/air leakage incidence*

None

- *Complications*

None

- *Anastomotic stenosis*

None

Insight

- **PGA sheets** may be an **effective** strategy for preventing anastomotic leakage in double-stapling technique anastomosis for rectal surgery.
- **PGA sheets** may **reduce** the risk of this dangerous post-operative issue

Acronyms

PubMed link

Buttress reload use for colorectal

Safety and efficacy of a novel linear staple device with bioabsorbable polyglicolic acid felt in laparoscopic colorectal surgery

Naito M. et al.

Asian journal of endoscopic surgery (2017) 10:1 (35-39)

The *objective* is to assess an automatic suture device with PGA felt to reinforce staple lines during gastrointestinal anastomosis, aiming to reduce postoperative anastomotic complications like leakage.

Retrospective study
17 pts

Indication: Colorectal cancer

PGA: Neoveil

Endo GIA Reinforced Reload with Tri-Staple Technology

DST Series
EEA Stapler (Medtronic)

Results

- *Anastomotic bleeding*

None

- *Operation time*

Median
159min (range, 113-322min)

- *Post-op Complications*

None

Insight

- The **automatic PGA-felt suture device** is safe and effective for colorectal resections and anastomoses, showing no postoperative bleeding or significant complications.

Acronyms

PubMed link

Buttress reload use for colorectal

Does Tri-Staple™ technology reduce the risk of anastomotic leakage in colorectal surgery? A propensity score matching analysis

Gerbasi LS et al.

J Surg Oncol. 2024 Sep;130(4):830-837

The *objective* is to evaluate the Tri-Staple™ technology in colorectal anastomosis

336 pts
EEA: 228
Tri-EEA: 108

Propensity score matching
DST™ Series technology (Medtronic) circular stapler (EEA): 108
EEA Tri-Staple™ (Medtronic) circular stapler (Tri-EEA): 108

Results

- *Anastomotic leakage/air leakage incidence*

EEA: 11%
Tri-EEA: 4%
p = 0.023

Propensity score matching
EEA: 12%
Tri-EEA: 4%
p = 0.04

- *Length of hospital stay*

EEA: 6.67 (0.66)
Tri-EEA: 5.3 (0.44)
p = 0.085

Propensity score matching
EEA: 6.68 (1.22)
Tri-EEA: 5.3 (0.44)
p = 0.110

- *Re-operations*

EEA: 12%
Tri-EEA: 4%
p = 0.016

Propensity score matching
EEA: 14%
Tri-EEA: 4%
p = 0.014

- *Severe complications*

EEA: 14%
Tri-EEA: 6%
p = 0.026

Propensity score matching
EEA: 15%
Tri-EEA: 6%
p = 0.041

Insight

- **Tri-Staple™** is associated with a **lower incidence** of leakage, reoperations, and severe complications, even after propensity score matching

Acronyms

PubMed link

Buttress reload use

Reduction of air leakage using linear staple device with bioabsorbable polyglycolic acid felt for pulmonary lobectomy

Deguchi H et al.

Gen Thorac Cardiovasc Surg. 2020 Mar;68(3):266-272

The *objective* is to investigate the effectiveness of using a linear staple device with bioabsorbable polyglycolic acid (PGA) in reducing air leakage after pulmonary lobectomy for non-small cell lung cancer (NSCLC)

Retrospective study
463 pts

Stapler group: 135 pts
Stapler-PGA group: 328 pts

Propensity score matching
Stapler group: 125 pts
Stapler-PGA group: 125 pts

Indication: non-small cell lung cancer (NSCLC)

PGA: Neoveil and Gunze

Results

- *Post-operative air leakage*

Stapler: 28/125 (22.4%)
Stapler-PGA: 12/125 (9.6%)
P= 0.006

- *Lenght of stay (days)*

Stapler: 10.7 ± 7.2
Stapler-PGA: 11.5 ± 12.4
P= 0.327

- *Operation time (min)*

Stapler: 248.9 ± 66.4
Stapler-PGA: 257.3 ± 53.8
P= 0.055

- *Post-operative complications*

Stapler: 35/125 (28.0%)
Stapler-PGA: 31/125 (24.8%)
P= 0.566

Insight

- **Stapler with PGA significantly reduced** postoperative air leakage.
- **PGA-reinforced stapler** is a valuable technique for minimizing complications and decreasing the need for additional interventions like fibrin glue.

Acronyms

PubMed link

Buttress reload use

A real-world study evaluating the safety and utility of a two-row stapler reload on pulmonary vasculature

Sandeep J. Khandhar et al.

J Thorac Dis. 2024;16(6):3753-3763.

The *objective* is to evaluate the safety and effectiveness of a two-row stapler reload (Signia™ Small Diameter Reload or SDR) when used on pulmonary vasculature during thoracic surgical procedures.

Prospective study
120 pts

Intervention: pulmonary vasculature

Signia™ Small Diameter Reloads

Results

- *Intraoperative hemostatic intervention rate*

0.99% (3/302)

- *Numbers of fires*

302; 48% of firings on arteries, 52% on veins
Reinforcement: applied to 14/302 (4.63%)

None of these procedures required conversion to an open procedure, a blood transfusion, suture placement, or the need for more extensive pulmonary parenchymal resection.

Likert scale
Integrous firings: 99%
Acceptable: 299
no intervention: 283

Manual handle: 60%
Powered handle: 40%

- *Adverse events*

No device-related injuries
Possibly device-related: 3/44 pts (6.8%)

Insight

- **Signia™ Small Diameter Reloads** demonstrates favorable safety and efficacy, with a low rate of hemostatic intervention

Acronyms

PubMed link

SECTION 3

Environmental impact

Article	Conclusions	
Bischofberger et al. 2023 Assessing the environmental impact of an anastomotic leak care pathway	The findings suggest that efforts to reduce the incidence and severity of surgical complications like anastomotic leak may lead to improvements in the overall environmental sustainability of surgical departments	PubMed link
Meissner et al. 2023 Evaluating the Environmental Impact of Single-Use (SUS) and Multi-Use Surgical Staplers (MUS) with Staple Line Buttressing in Laparoscopic Bariatric Surgery	The survey indicates that using MUS with pre-attached buttressing significantly reduces waste, resource consumption, and greenhouse gas emissions compared to using SUS with separate buttressing in bariatric surgery	PubMed link
Meissner et al. 2021 Evaluating the Waste Prevention Potential of a Multi-versus Single-Use Surgical Stapler.	The study suggests that switching from single-use to multi-use surgical stapling systems can substantially reduce waste and resource consumption in surgical procedures, provided that the multi-use components are adequately reused	PubMed link

Environmental impact

Assessing the environmental impact of an anastomotic leak care pathway

Bischofberger S. et al.

Surg Open Sci. 2023;14:81-86

The *objective* is to assess the environmental impact associated with the care pathway of anastomotic leak (AL)

Insight

- **Anastomotic leak** (AL) **patients** have an **increased length of hospital stay**, spending an additional 8.36 days in general inpatient care and 1.50 days in intensive care, on average, compared to those who do not experience leaks.
- The **treatment of AL** is **associated with** a substantial **environmental impact**. The average environmental impact per patient is 1303 kg CO2-eq for climate impact, 1803 m3 of water for water impact, and 123 kg of waste for waste impact.
- **Stoma home management** is the **largest contributor** to the **climate impact** of AL patients, accounting for 46.6% (607 kg CO2-eq) of the total, and 47.3% (58.1 kg) of the total waste impact. The majority of the climate and water impact of stoma home management is associated with the manufacture of ostomy bag material.
- **In-patient days** make the **largest contribution** to the total **water impact**, accounting for 46.7% (841.1 m3) of the total water footprint of AL patients. The environmental impact of in-patient care is largely associated with the use of energy and consumables.
- The findings suggest that efforts to **reduce the incidence and severity of surgical complications like AL** may lead to **improvements in the overall environmental sustainability** of surgical departments.

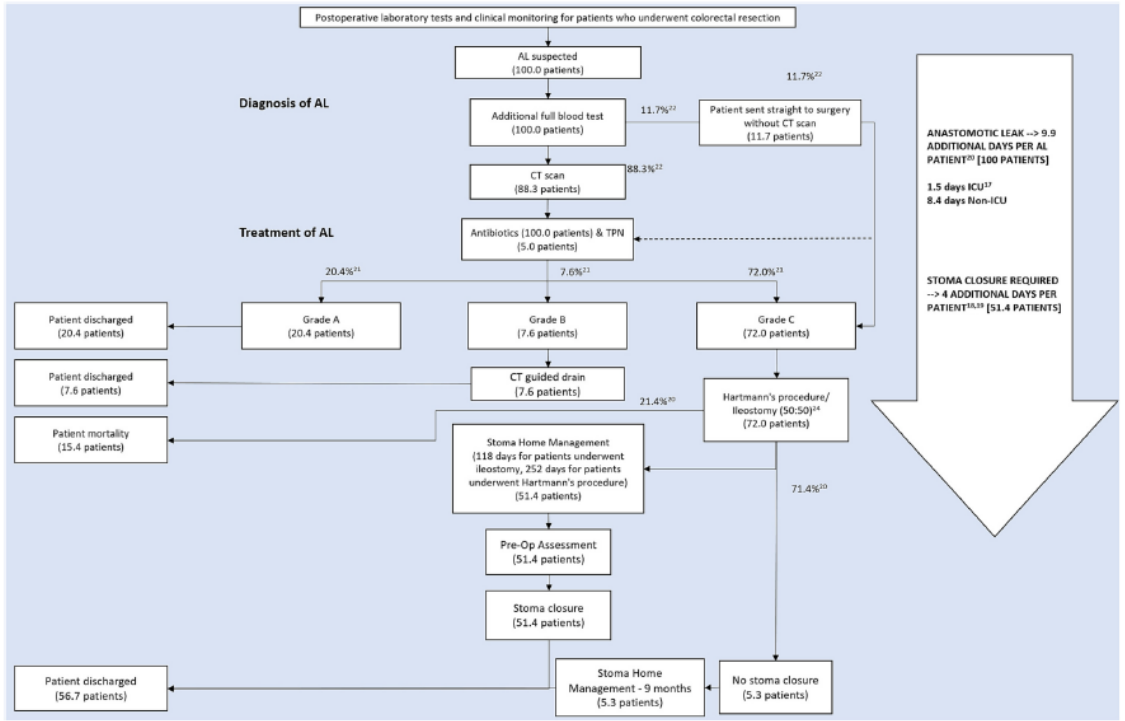

Fig. 1. Care pathway for the treatment of patients with AL.
Based on 100 patients experiencing AL.

Acronyms

PubMed link

Environmental impact

Evaluating the Environmental Impact of Single-Use and Multi-Use Surgical Staplers with Staple Line Buttressing in Laparoscopic Bariatric Surgery

Meissner M. et al.

Risk Manag Healthc Policy. 2023;16:1423-1433

Survey of bariatric surgeons

The *objective* is to assess the environmental impact of single-use versus multi-use surgical staplers in bariatric surgery, focusing on staple line buttressing.

Results

- *Environmental Awareness*

Concerned: 12 (67%)
Hospital promotes environmentally friendly purchasing: 22%

- *Priorities in Purchasing Decisions*

Never made changes to their work practice based on environmental concerns: 50%
Prioritize ease of use and price over environmental impact: 61%

- *Surgeon Practices*

Staple line reinforcement: 12/18 (67%)
Powered staplers over manual staplers: 88%

- *Cartridge Usage*

Sleeve gastrectomy (SG): 0.6 45mm cartridges and 5.0 60mm cartridges.
Roux-en-Y gastric bypass (RYGB): 0.2 30mm cartridges, 1.0 45mm cartridges, and 5.0 60mm cartridges.
Bariatric surgery: 60mm cartridges

- *Waste Generation*

MUS reduce product waste by 40% in both sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB) procedures.
MUS reduce packaging waste by 60% in SG and 57% in RYGB.
Overall, MUS reduce total waste by 50% for SG and 48% for RYGB

- *Total Material Requirement (TMR)*

The TMR is reduced by more than 90% when using MUS compared to SUS for both SG and RYGB procedures

- *Lithium Content and Greenhouse Gas Emissions*

Lithium
MUS: 4.96%
SUS: 6.72%
The greenhouse gas impact
MUS: 0.018 g CO_2eq
SUS: 5.904 g CO_2eq

- *Sensitivity Analysis*

If buttressing is applied to all staple lines, the waste reduction offered by the MUS increases to 1,022.13 g (54.7%) compared to 649.88 g (45.6%) if no staple line reinforcement is used.

Insight

- The survey highlights that while many surgeons are aware of the environmental issues associated with surgical practices, environmental concerns are not a primary driver in their purchasing decisions.
- Multi-use staplers (MUS) significantly reduce waste compared to single-use staplers (SUS).
- Preloaded buttressing in MUS produces less waste than separate buttressing used with SUS per stapler firing.
- Although MUS have a higher TMR per cartridge than SUS, the reusability of MUS components leads to a significant overall reduction in TMR.
- MUS contain less lithium than SUS
- Sensitivity analysis, shows that MUS generate less waste and have lower TMR than SUS, regardless of the rate of buttressing applied.

Acronyms

PubMed link

Environmental impact

Evaluating the Waste Prevention Potential of a Multi- versus Single-Use Surgical Stapler

Meissner M. et al.

Risk Manag Healthc Policy. 2021;14:3911-3921

The *objective* is to evaluate the waste prevention potential and extended resource use of multi-use surgical stapling systems (MUS) versus single-use surgical stapling systems (SUS).

Ethicon's SUS:
ECHELON FLEX™

Medtronic's MUS: Signia™ Stapling Technology

Mechanically deconstruction

Results

- *Waste Generation*

Sleeve gastrectomy: reduced by 0.29 kg
Gastric bypass: reduced by 0.96 kg
VATS lobectomy: reduced by 0.86 kg
Waste when using the MUS compared to the SUS.

- *Total Material Requirement (TMR)*

60 mm power handle and adapter (PSEE60A) of the SUS is the most resource-intensive component, requiring 328 kg of resources
Power handle (SIGPHANDLE) of the MUS is the most resource-intensive component, requiring 560 kg of resources.

Sleeve gastrectomy: decreased from 329 kg to 27 kg
Gastric bypass: decreased from 633 kg to 25 kg
VATS lobectomy: decreased from 633 kg to 34 kg
when switching from a SUS to a MUS

- *Sensitivity Analysis*

Single-use MUS scenario, waste generation increases by 1.13 kg for laparoscopic sleeve gastrectomy, 0.46 kg for laparoscopic gastric bypass, and 0.57 kg for VATS lobectomy when compared to SUS.
To achieve a lower TMR with the MUS than the SUS, the multi-use MUS components must be used at least three times.

Insight

- Use of the MUS leads to a reduction in the total amount of system waste accumulated per surgical procedure, compared to SUS. 40% for laparoscopic sleeve gastrectomy, 70% for laparoscopic gastric bypass, and 62% for VATS lobectomy procedures.
- TMR decreased significantly when switching from SUS to MUS. TMR reductions were higher, at 92% (sleeve gastrectomy), 96% (gastric bypass), and 95% (VATS lobectomy).
- If the multi-use components of the MUS are used more than once, the reduction in waste and TMR associated with a switch from SUSs to MUSs is maintained for a range of reuses.

Acronyms
PubMed link