

Scoping review and meta-analysis on the effectiveness and safety of powered stapler and manual stapler

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Background

- Staplers have been widely used in wound suturing, organ removal, organ transection and anastomosis in cardiothoracic surgery, gastrointestinal surgery, hepatobiliary, splenic and pancreatic surgery, general surgery, urology and other surgical fields [1,2].
- Staplers can reduce bleeding, reduce the risk of postoperative air leakage, and tissue damage ^[3]. Staplers can be classified as powered stapler and manual stapler according to the power mode.
- Few studies comparing the clinical safety and efficacy of powered stapler and manual stapler, and the research conclusions are different [4-6].







Objective

To evaluate effectiveness and safety of the powered staplers versus manual staplers performing in surgery.

Methods

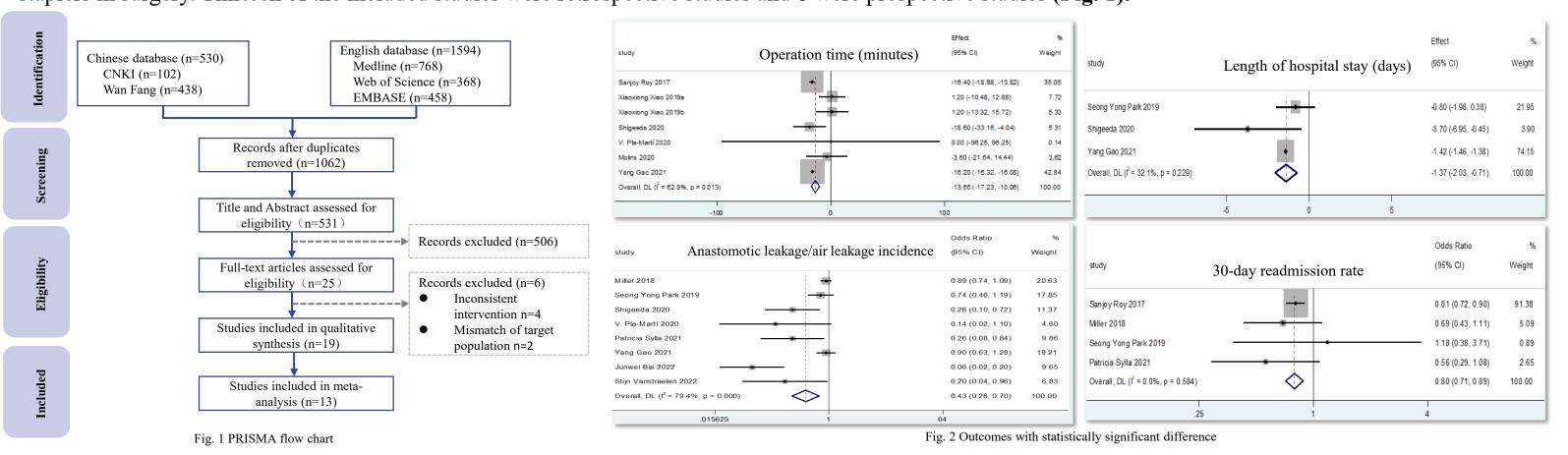
- Keywords such as "stapler", "powered stapler", "manual stapler", "effectiveness" and "safety" were systematic searched in CNKI, Wan Fang, Medline(PubMed), EMBASE and Web of Science database. The search period was from January 1, 2012 to November 27, 2022.
- **Population:** Adult patients of cardiothoracic, gastrointestinal, liver, general surgery; **Intervention (Comparator):** Different types of powered or manual stapler; **Study design:** RCT, non-RCT, observational study etc.

Methods

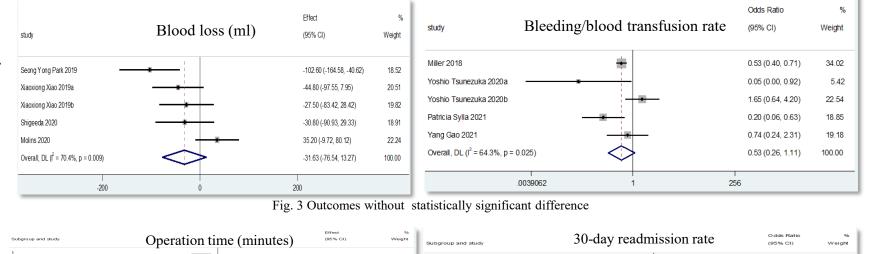
- **Primary outcomes:** operation time, length of hospital stay, blood loss, anastomotic leakage/air leakage incidence, bleeding/blood transfusion rate, 30-day readmission rate, physician satisfaction and instrument performance index.
- **Statistical methods:** Meta-analysis was conducted to calculate odds ratio (OR) and mean difference (MD) with corresponding 95% confidence intervals. Further subgroup analysis was conducted to compare powered with manual in linear/vascular staplers and powered with manual in circular staplers.

Results

• A total of 19 studies were included in final analysis, with 6 single-arm studies on powered staplers and 13 studies comparing the use of powered and manual staplers in surgery. Thirteen of the included studies were retrospective studies and 6 were prospective studies (Fig. 1).



- Meta analysis
 - Statistically significant differences were observed in terms of operation time, length of hospital stay, anastomotic leakage/air leakage incidence, and 30-day readmission rate in favor of powered staplers (Fig. 2).
 - ➤ No statistically significant differences were observed for blood loss, bleeding/blood transfusion rate (Fig. 3).
 - Subgroup analysis showed that powered linear/vascular staplers significantly reduced the operation time and 30-day readmission rate. Compared with manual circular staplers, powered circular staplers significantly reduced the incidence of anastomotic leakage (Fig. 4).



abgroup and study	Operation time (minutes)	Effect (95% CI)	% Weight	Subgroup and study	30-day readmission rate	Odds Ratio (95% CI)	% Weight
injoy Roy 2017	-	-16.40 (-18.98, -13.82)	35.05	1			
ioxiong Xiao 2019a		1.20 (-10.48, 12.88)	7.72	Sanjoy Roy 2017		0.81 (0.72, 0.90)	91.38
aoxiong Xiao 2019b		1.20 (-13.32, 15.72)	5.33	Miller 2018		0.69 (0.43, 1.11)	5.09
igeeda 2020		-18.60 (-33.16, -4.04)	5.31	Seong Yong Park 2019	-	1.18 (0.38, 3.71)	0.89
lins 2020	-	-3.60 (-21.64, 14.44)	3.62 42.84	Subgroup, DL (f = 0.0%, p = 0.661)		0.80 (0.72, 0.90)	97.35
ng Gao 2021 bgroup, DL (I ² = 68.8%, p = 0.007)		-16.20 (-16.32, -16.08) -13.53 (-17.23, -9.83)	99.86		T		
-g,	Y	(, ,		2			
				Patricia Sylla 2021	-	0.56 (0.29, 1.08)	2.65
Pla-Martí 2020		0.00 (-96.25, 96.25)	0.14	Subgroup, DL (f = 0.0%, p = .)		0.56 (0.29, 1.08)	2.65
ogroup, DL (I ² = 0.0%, p = .)		0.00 (-96.25, 96.25)	0.14				
erogeneity between groups: p = 0.783				Heterogeneity between groups: p = 0.290			
erall, DL (I ² = 62.8%, p = 0.013)	♦	-13.65 (-17.23, -10.06)	100.00	Overall, DL ($l^2 = 0.0\%$, p = 0.584)	\Diamond	0.80 (0.71, 0.89)	100.00
-100	·	100		.25	1	4	
-100	•					-	
ubaroup and study A nactom	otio lookaga/air lookaga ingidar	Odds Ratio	% Weight			Odds Ratio	%
Allastolli	otic leakage/air leakage incider	CE (SS/CS/)	vveignt	Subgroup and study Rice	ding/blood transfusion rate	(95% CI)	Weight
				Dico	ding blood transfasion rate	,	
filler 2018	=	0.89 (0.74, 1.09)	20.63	1			
eong Yong Park 2019	_ =	0.74 (0.46, 1.19)	17.85	Miller 2018		0.53 (0.40, 0.71)	34.02
higeeda 2020 ang Gao 2021		0.26 (0.10, 0.72) 0.90 (0.63, 1.28)	11.37 19.21	Yoshio Tsunezuka 2020a —	*	0.05 (0.00, 0.92)	5.42
ubgroup, DL (1° = 49.0%, p = 0.117)	7	0.79 (0.60, 1.05)	69.06	Yoshio Tsunezuka 2020b	 	1.65 (0.64, 4.20)	22.54
angioup, de (doing p of the)	\preceq	0.10 (0.00, 1.00)		Yang Gao 2021		0.74 (0.24, 2.31)	19.18
				Subgroup, DL (I ² = 62.6%, p = 0.046)		0.67 (0.31, 1.49)	81.15
Pla-Martí 2020	 	0.14 (0.02, 1.10)	4.60				
atricia Sylla 2021		0.26 (0.08, 0.84)	9.86	2			
inwei Bai 2022 ——	•	0.06 (0.02, 0.20)	9.65	Patricia Sylla 2021		0.20 (0.06, 0.63)	18.85
tijn Vanstraelen 2022 ubgroup, DL (1 ² = 9.2%, p = 0.347)		0.20 (0.04, 0.96)	6.83	Subgroup, DL ($I^2 = 0.0\%$, p = .)		0.20 (0.06, 0.63)	18.85
angroup, DE (1 - 92 %, p - 0.547)		0.14 (0.07, 0.29)	50.54				
eterogeneity between groups: p = 0.0	100			Heterogeneity between groups: p = 0.086	3		
verall, DL (12 = 79.4%, p = 0.000)		0.43 (0.26, 0.70)	100.00	Overall, DL (I ² = 64.3%, p = 0.025)	\Leftrightarrow	0.53 (0.26, 1.11)	100.00

Results

- Qualitative synthesis
 - Powered stapler is more convenient to use, has better usability [7-9], and with short learning curve^[9].
 - ➤ Powered stapler was more user-friendly, better instrument performance^[8].

Conclusion

Our study showed superiority of powered staplers compared to manual staplers in operation time, length of hospital stay, anastomotic leakage/air leakage incidence and 30-day readmission rate. However, further high-quality studies are needed to obtain definitive conclusions.

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