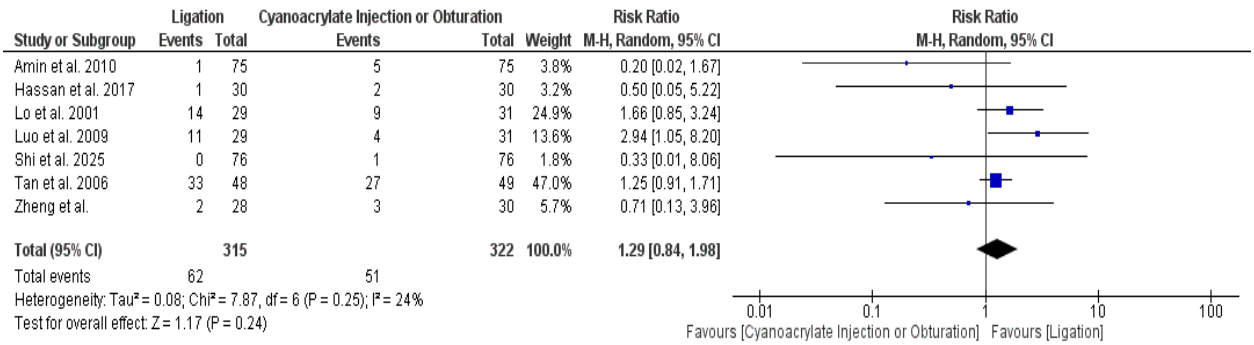
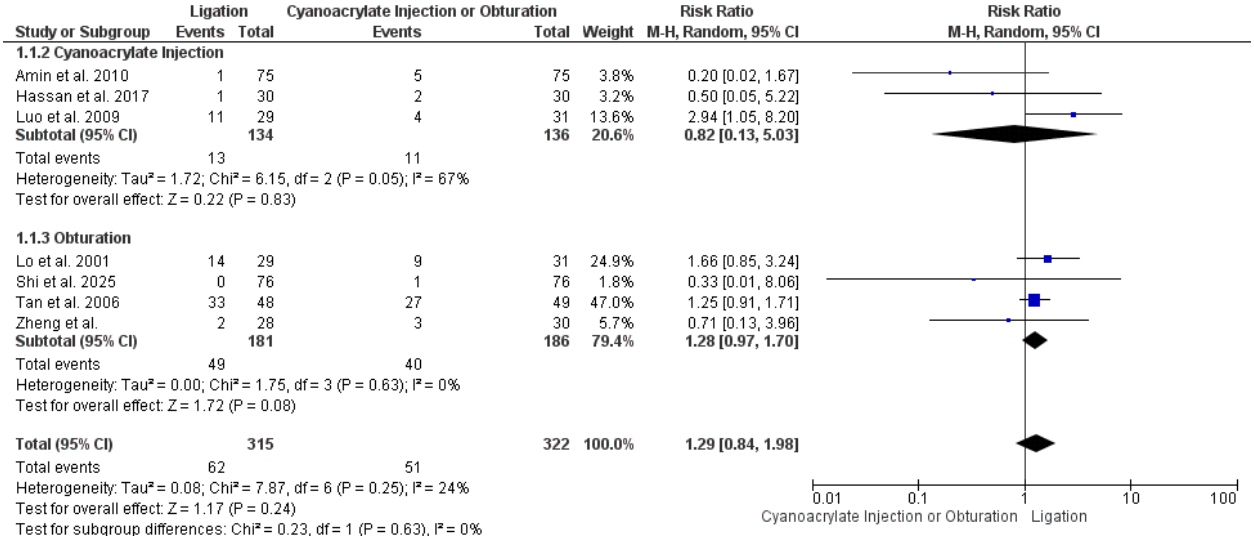
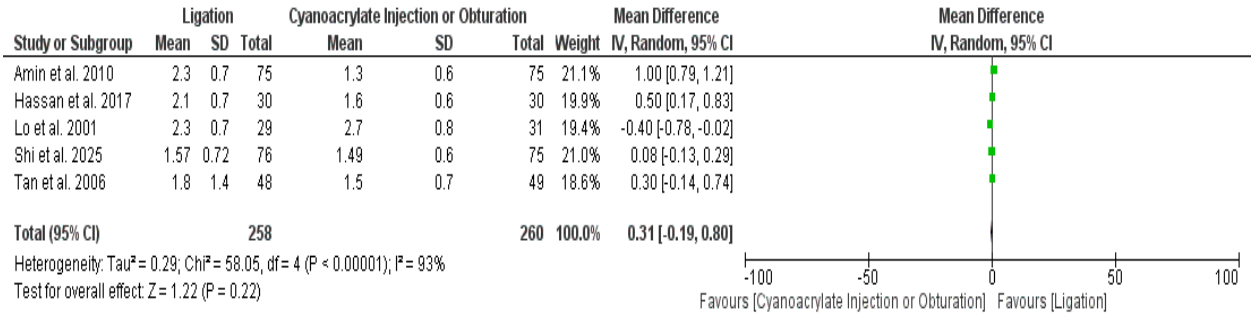


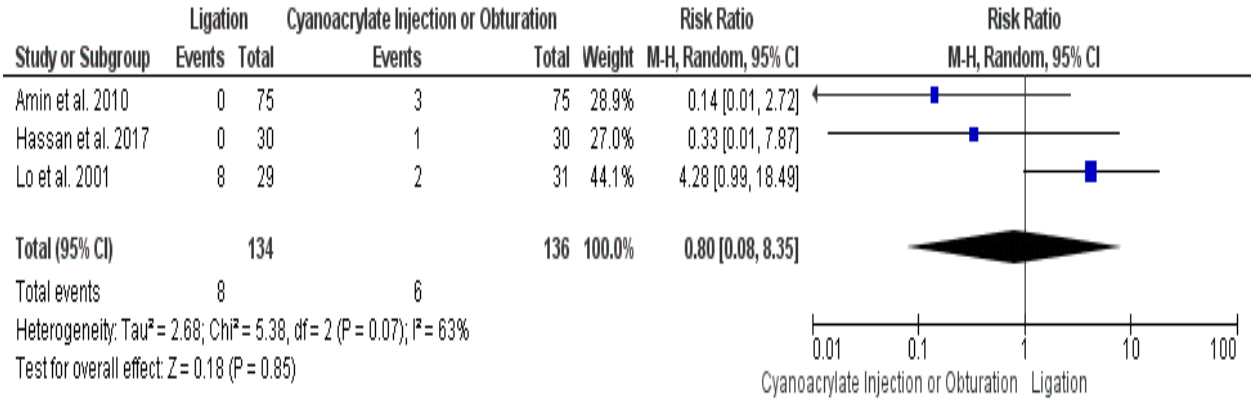
Supplementary Figure 1 Forest plot comparing all-cause mortality between EVL and cyanoacrylate therapy. Pooled risk ratio (RR) with 95% CI calculated using a random-effects model. No statistically significant difference was observed between groups (RR = 1.29; 95% CI [0.84–1.98]; I^2 = 21%). aMortality assessed at longest follow-up time.



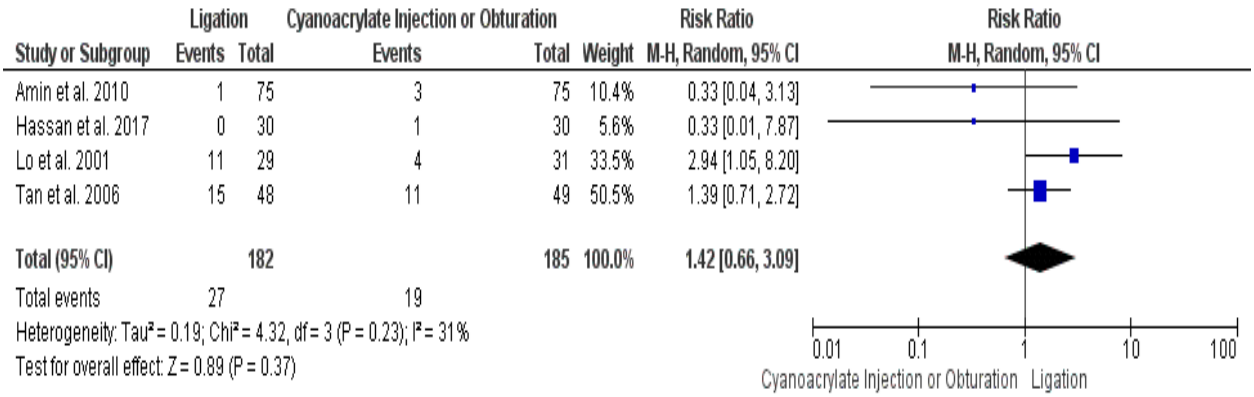
Supplementary Figure 2 Subgroup analysis of all-cause mortality by cyanoacrylate delivery method. Injection subgroup: RR = 0.82 (95% CI [0.13–5.03]); high heterogeneity ($I^2 \approx 70\%$). Obturation subgroup: RR = 1.28 (95% CI [0.97–1.70]); I^2 = 0%. Test for subgroup differences was non-significant ($p > 0.05$). a Subgroup analysis pre-specified in protocol.



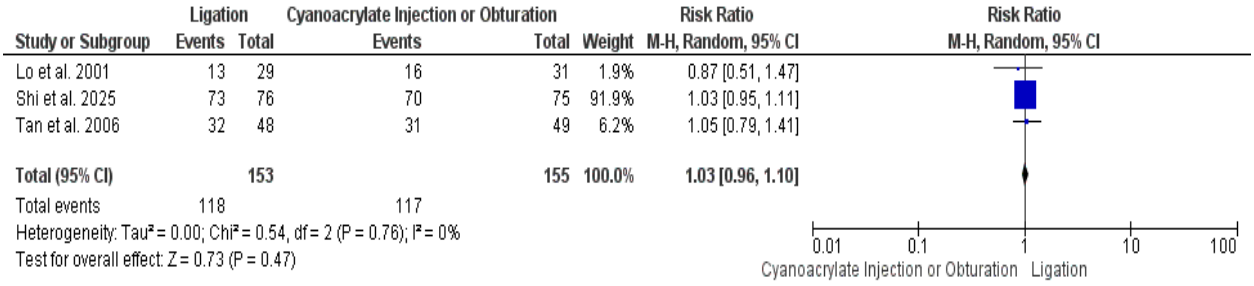
Supplementary Figure 3 Forest plot comparing the number of sessions required for variceal obliteration between EVL and cyanoacrylate therapy. No significant difference observed (MD = 0.31 sessions; 95% CI [–0.19–0.80]; I^2 = 76%). a MD = mean difference.



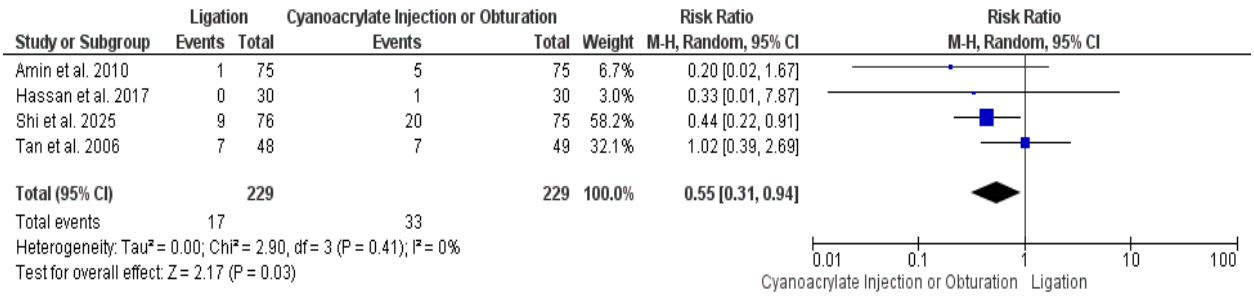
Supplementary Figure 4 Forest plot comparing fatal bleeding events between EVL and cyanoacrylate therapy. No significant difference observed between groups (RR = 0.80; 95% CI [0.08–8.35]; I^2 = 54%). a Fatal bleeding defined as death directly related to variceal hemorrhage.



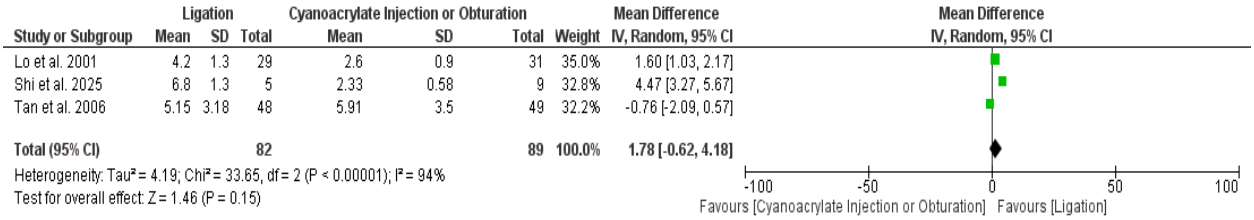
Supplementary Figure 5 Forest plot comparing treatment failure between EVL and cyanoacrylate therapy. No significant difference in treatment failure rates (RR = 1.42; 95% CI [0.66–3.09]; I^2 = 20%). a Treatment failure defined as failure to achieve initial hemostasis or early rebleeding.



Supplementary Figure 6 Forest plot comparing variceal obliteration rates between EVL and cyanoacrylate therapy. Pooled RR indicated no significant difference between interventions (RR = 1.03; 95% CI [0.96–1.10]; I^2 = 0%). a Obliteration confirmed endoscopically.



Supplementary Figure 7 Forest plot comparing post-procedural fever between EVL and cyanoacrylate therapy. EVL was associated with a significantly lower risk of post-procedural fever (RR = 0.55; 95% CI [0.31–0.94]; I^2 = 0%). a Fever defined as ≥38 °C within 24 hours post-procedure.



Supplementary Figure 8 Forest plot comparing blood transfusion requirements between EVL and cyanoacrylate therapy. No significant difference observed (MD = 1.78 units; 95% CI not significant), with substantial heterogeneity (I^2 > 75%). a Blood transfusion recorded during index hospitalization.

Supplementary Table 1 PICO and Search Strings

Population	Intervention	Control	Outcomes
Patients with gastric Varices	Endoscopic band ligation	Endoscopic Variceal Obturation/Cyanoacrylate Injection	Initial hemostasis/rebleeding
KeyWords			
PubMed	(((Cyanoacrylate Injection) OR (Cyanoacrylate)) AND (Band Ligation)) AND (gastric variceal bleeding)		78
Embase	('cyanoacrylate injection'/exp OR 'cyanoacrylate'/exp OR cyanoacrylate:ti,ab,kw OR 'cyanoacrylate injection':ti,ab,kw OR 'glue injection':ti,ab,kw) AND ('band ligation'/exp OR 'endoscopic band ligation'/exp OR 'endoscopic variceal ligation'/exp OR 'band ligation':ti,ab,kw OR 'endoscopic band ligation':ti,ab,kw OR 'endoscopic variceal ligation':ti,ab,kw OR evl:ti,ab,kw) AND ('gastric varices'/exp OR 'gastric variceal bleeding'/exp OR 'gastric variceal hemorrhage':ti,ab,kw OR 'bleeding gastric varices':ti,ab,kw OR 'gastric varices':ti,ab,kw)		43

Cochrane	(Cyanoacrylate:ti,ab,kw OR "Cyanoacrylate Injection":ti,ab,kw OR "Glue Injection":ti,ab,kw) AND ("Band Ligation":ti,ab,kw OR "Endoscopic Band Ligation":ti,ab,kw OR "Endoscopic Variceal Ligation":ti,ab,kw OR EVL:ti,ab,kw) AND ("Gastric Varices":ti,ab,kw OR "Gastric Variceal Bleeding":ti,ab,kw OR "Gastric Variceal Hemorrhage":ti,ab,kw OR "Bleeding Gastric Varices":ti,ab,kw)	39
Clinical Trials Registry		5

Supplementary Table 2 Baseline characteristics of included studies

Study ID	**Group**	**N**	**Age (mean ± SD)**	**Sex (M/F)**	**HCC Presence**	**Albumin (g/dL) (mean ± SD)**	**Bilirubin (mg/dL) (mean ± SD)**	**Hemoglobin (g/dL) (mean ± SD)**	**Platelets (/mm³) (mean ± SD)**	**Creatinine (mg/dL) (mean ± SD)**
Amin (2010)	EVL	75	52 ± 6	53/22	NR	3.38 ± 0.6	2.3 ± 0.8	8.5 ± 1.2	239 ± 71.2	0.98 ± 0.67
	Cyanoacrylate	75	51 ± 4	55/20	NR	3.0 ± 0.6	2.7 ± 1.0	8.4 ± 1.7	213.6 ± 81.2	1.1 ± 0.39
Hassan	EVL	30	49 ± 5	19/11	0/30	3.28 ± 0.4	2.1 ± 0.7	8.7 ± 1.3	230 ± 61.2	0.94 ± 0.52

(2017)	Cyanoacrylate	30	51 ± 3	21/9	0/30	3.12 ± 0.6	2.5 ± 0.9	8.3 ± 1.6		215 ± 75.3	1.0 ± 0.42	
Lo (2001)	GVL	29	55 ± 13	22/7	10/29	3.2 ± 1.2	2.0 ± 1.0	NR		NR	NR	
	GVO	31	58 ± 17	24/7	7/31	3.0 ± 1.1	2.3 ± 0.9	NR		NR	NR	
Luo (2009)	EVL	29	51.29 ± 4.73	NR	NR	NR	NR	NR		NR	NR	
	Cyanoacrylate	31	50.63 ± 7.39	NR	NR	NR	NR	NR		NR	NR	
Shi (2025)	EBL	77	57.49 ± 11.51	58/19	16/77	NR	NR	NR		NR	NR	
	EVO	77	55.32 ± 10.21	59/18	14/77	NR	NR	NR		NR	NR	
Tan (2006)	GVL	48	61.77 ± 12.35	34/14	23/48	2.89 ± 0.54	1.93 ± 1.36	8.98 ± 2.29	±	90.56 ± 55.20	1.19 ± 0.68	
	GVO	49	61.35 ± 14.63	35/14	23/49	2.90 ± 0.47	2.42 ± 3.37	9.18 ± 1.87	±	105.9 ± 67.87	1.37 ± 1.12	

Zheng (et al.)	GVL	28	NR	NR	NR	NR	NR	NR	NR	NR
	GVO (30)		NR	NR	NR	NR	NR	NR	NR	NR

Study ID)	Group	Prothrombin (mean ± SD)	Ascites	Encephalopathy	GV Type (Sarin)	GV Size (Hashizume)	Concomitant EV	Active Bleeding	Hemodynamic Instability	Blood Transfusion
Amin (2010)	EVL	66.8 ± 8.2	NR	0/75	GOV1	NR	NR	75/75	6	NR
	Cyanoacrylate	60.7 ± 12.1	NR	0/75	GOV1	NR	NR	75/75	14	NR
Hassan (2017)	EVL	63.2 ± 8.2	NR	0/30	NR	NR	NR	30/30	4	NR
	Cyanoacrylate	59.7 ± 10.6	NR	0/30	NR	NR	NR	30/30	8	NR
Lo (2001)	GVL	NR	17 (59%)	0/29	GOV1=20, GOV2=8, IGV1=1	F1=2, F2=19, F3=8	28 (96%)	29/29	NR	4.2 ± 1.3
	GVO	NR	15 (48%)	0/31	GOV1=21, GOV2=6,	F1=1, F2=21, F3=9	27 (87%)	31/31	NR	2.6 ± 0.9

					IGV1=4						
Luo (2009)	EVL	NR		NR	NR	NR	NR	NR	29/29	NR	NR	
	Cyanoacrylate	NR		NR	NR	NR	NR	NR	31/31	NR	NR	
	EBL	NR		NR	NR	GOV1=37, GOV2=24, IGV1=16	F1=8, F2=47, F3=22	NR	77/77	30	NR	
Shi (2025)	EVO	NR		NR	NR	GOV1=46, GOV2=23, IGV1=8	F1=5, F2=40, F3=32	NR	77/77	38	NR	
	GVL	2.63	± 2.26	26/48	6/48	GOV1=26, GOV2=16, IGV1=6	F1=10, F2=24, F3=14	NR	48/48	NR	5.15 ± 3.18	
Tan (2006)	GVO (Control)	2.44	± 1.55	25/49	5/49	GOV1=27, GOV2=9,	F1=10, F2=22, F3=17	NR	49/49	NR	5.91 ± 3.50	

					IGV1= 13					
Zheng (et al.)	GVL (Intervention)	NR	NR	NR	NR	NR	NR	28/28	NR	NR
	GVO (Control)	NR	NR	NR	NR	NR	NR	30/30	NR	NR

Values are expressed as mean ± SD or n (%), unless otherwise stated. NR = Not reported; EVL = Endoscopic Variceal Ligation; EBL = Endoscopic Band Ligation; GVL = Gastric Variceal Ligation; GVO = Gastric Variceal Obliteration; EVO = Endoscopic Variceal Obliteration; HCC = Hepatocellular carcinoma; GV = Gastric varices; EV = Esophageal varices; GOV = Gastroesophageal varices; IGV = Isolated gastric varices. GV type classified according to Sarin; GV size according to Hashizume.

Supplementary Table 3 Study characteristics of included trials

Study ID	**Country**	**Study Design**	**Population (Sample Size, Age, Sex)**	**Intervention (Type, Dose, Duration)**	**Comparator (if any)**	**main inclusion criteria**	**Primary Outcomes**	**secondary outcome**	**Conclusion**

Amin *et al.* (2010)	Cairo, Egypt; conducted at three endoscopy centers in upper Egypt: Assiut, Minya and Al-azhar university	A randomized trial; Randomized control clinical trial	150 patients. **Age:** ranged from 20 to 60 years, mean ± SD of 52.0 ± 6.0 years. **Sex:** 108 males and 42 females (72% males, 28% females)	EVL of junctional varices (Group I: 75 patients). Sessions continued till obliteration of the varices. Repeated every 2 weeks until obliteration	Cyanoacrylate injection (Group II: 75 patients). N-butyl-2-cyanoacrylate (Histoacryl Blue, Germany) injected in travariceally (0.5 mL cyanoacrylate + 0.7 mL Lipiodol per aliquot).	Patients with portal hypertension based on clinical, laboratory and imaging studies; Patients with clinical signs of hematemesis, melena or hematochezia; Patients with active bleeding from junctional varices	Initial hemostasis (defined as cessation of bleeding for more than 72 hours).	Survival time and complications or death.	EVL may be a good alternative to cyanoacrylate injection in treatment of bleeding junctional varices.

	hospitals			achieved.		(active spurting or oozing); Patients who gave informed written consent; Aged 20 to 60 years.			
Hassan *et al*	Services Hospital, Lahore (Implied Pakistan)	A randomized controlled trial	60 patients. **Age:** ranged from 25 to 72 years, with a mean ± SD of 50.0 ± 4.0	EVL of gastric varices (Group I: 30 patients). Endoscopic sessions continued	Cyanoacrylate injection (Group II: 30 patients). Endoscopic sessions continued till obliteration of the varices, repeated	Patients aged between 20 and 70 years; endoscopy-proven acute GVH (including clinical signs of bleeding, endosco	Initial hemostasis (defined as cessation of bleeding for more	Survival time and complications or death.	Cyanoacrylate glue injection is superior to EVL for achieving hemostasis and preve

			years. **Sex:** 40 males (67%) and 20 females (33%).	till obliteration of the varices, repeated every 2 weeks.	every 2 weeks.	pic visualization of active bleeding /stigmata, or large GV with red-color signs and no other source).	than 72 hours).		nting recurrence of gastric variceal reblee ding but has no advantage over GVL for mortality and complications.
Lo *et al.* (2001)	Kaohsiung Veterans General Hos	Prospective, Randomized Trial	60 patients enrolled (GVO: 31, GVL:	Endoscopic obturation (GVO group: 31 patien	Band Ligation (GVL group: 29 patients). Pneumatic-active ligating	Patients were cirrhotic; had the history of gastric variceal bleeding;	Initial hemostasis (defined as	Reblee ding, complications (*e.g.*, ulcer bleedi	Endoscopic obturation using cyanoacrylate

pital, Taipei, Taiwan, Republic of China	29). **Age:** GVO 58 ± 17, GVL 55 ± 13. **Sex:** GVO 24/7 M/W, GVL 22/7 M/W.	ts). N-butyl-2-cyanoacrylate (Histoacryl) 0.5 mL mixed with 1.5 mL Lipiodol 2 mL (rarely 4 mL) used per session. Performed regularly at 3- to 4-week interv	device used. 1 to 4 rubber bands applied during 1 session. Performed regularly at 3- to 4-week intervals until obliteration.	between 20 and 70 years of age. GV bleeding defined by active spurting /oozing or stigmata of recent hemorrhage.	cessation of bleeding for more than 72 hours).	ng, bacteremia, bacterial peritonitis), blood transfusion requirements, and survival.	proved more effective and safer than band ligation in the management of bleeding gastric varices.

			als until obliteration.					

Study ID	Country	Study Design	Population (Sample Size, Age, Sex)	Intervention (Type, Dose, Duration)	Comparator (if any)	main inclusion criteria	Primary Outcomes	secondary outcome	Conclusion
Shi *et al.* (2025)	Multicentre study (Ningbo No. 2 Hospital and The First Peopl	Multicentre prospective randomised trial	154 patients (EBL: *n* = 77; EVO: *n* = 77). **Age:** average age of 56.41 ± 10.90	EBL with large-volume ligators (EBL group: *n* = 77). Saeed 10 Shooter Multi-	EVO (Endoscopic Variceal Obturation) (EVO group: *n* = 77). Histoacryl (N-butyl-2-cyanoacrylate) 0.5–	(1) Active UGI bleeding/haematemesis, history of liver cirrhosis or liver cancer/portal hypertension; (2) GOV1,	Initial haemostasis success rate; 3-month GV eradication rate; 1-week rebleeding rate; 6-month cumulati	Blood transfusion rate and average volume in patients with rebleeding; endoscopic	The short-term efficacy of EBL with large-volume ligators in the treatm

e's Hospital of Yongkang, Zhejiang, China)	years. **Sex:** 117 males and 37 females.	Band Ligator used. Treatment repeated at 1, 3, and 6 months if residual GV remained.	1 mL injected *via* sandwich technique (with lauromacrogol). Treatment repeated at 1, 3, and 6 months if residual GV remained.	GOV2, or IGV1 with jet or gush-like bleeding; (3) Blood accumulation (>100 mL) + unstable vital signs (SBP ≤ 90 mmHg and/or HR > 120 bpm); (4) GV transverse diameter < 2 cm.	ve rebleeding rate; recurrence rate within 6 months.	treatment-related adverse events (fever, sepsis, distant embolisation, and death).	ent of actively bleeding GV is similar to that of EVO; however, postoperative rebleeding is often more dangerous in EBL than in EVO.

Tan *et al.* (2006)	Veterans General Hospital-Taipei, Taipei, Taiwan	Prospective randomized trial	97 patients (GVL: 48, GVO: 49) included for final modified ITT analysis. **Age:** GVL 61.77 ± 12.35, GVO 61.35 ± 14.63. **Sex:** GVL 34/14 M/F, GVO 35/14 M/F.	Endoscopic band ligation (GVL, n = 48). Mean bands per session 4.5 ± 2.6 (range, 1-10). Performed at regular intervals of 3 to 4 weeks until varices were eradicated.	Endoscopic N-butyl-2-cyanoacrylate injection (GVO, n = 49). 0.5 mL cyanoacrylate + 0.5 mL Lipiodol per shot. No more than six shots per session. Performed at regular intervals of 3 to 4 weeks until varices were	Patients with cirrhosis with or without concomitant HCC who presented with acute GVH. Aged between 18 and 80 years. GVH confirmed by endoscopy (active bleeding, stigmata, or large GV with red-color sign).	Control of active bleeding; GV rebleeding.	Mortality.	GVO is associated with a lower GV rebleeding rate. GVO is the superior choice for treating GVH.

					eradicated.				
Zheng *et al.*	Guangzhou, China (The 3rd Affiliated Hospital of Sun Yat-sum University)	A randomized trial	58 patients with GVH. **Age:** NR. **Sex:** NR.	Gastric Band Ligation (GVL group, n = 28). Sessions performed every 4 weeks if necessary.	N-butyl-2-cyanoacrylate injection (GVO group, n = 30). Each shot contained 0.5 mL cyanoacrylate and 0.5 mL lipiodol. Sessions performed every 4 weeks if	Patients with GVH.	Bleeding control rates in 24 hr; disappeared rate of gastric varices; two-year accumulated rebleeding rate.	Improved rate of gastric varices; complication rate; death rates (two-year accumulated).	GVL and GVO are both effective methods in treatment of gastric varices hemorrhage.

necessary

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Luo *et al.* (2009)	Guangzhou, Guangdong Province, China (the 8th People's Hospital of Guangzhou)	Analysis of 97 cases where patients were randomly divided into 3 groups	97 inpatients. **Age:** average age 5234 ± 8.12. **Sex:** 79 males and 18 females.	Cyanoacrylate injection (*n* = 31 cases). Domestic α-cyanoacrylate rapid medical glue TH type used; 1.0 mL rapidly injected. Average of 6	EIS (Endoscopic Injection Sclerotherapy) (*n* = 37 cases). 50 g/L sodium morrhuate injection used; 5-10 mL for GV. Average of 6 months' follow-up.	Inpatients with digestive bleeding diagnosed *via* emergency endoscopy as having gastric variceal hemorrhage.	Haemostasis rates; incidence of local ulcer; short-term rehaemorrhagia; mortality.	Long-term therapeutic efficacy.	Endoscopic sclerotherapy and endoscopic injection of cyanoacrylate are more effective and safer than endoscopic ligation for gastric

	months, follow-up.		varices.

RCT = Randomized controlled trial; ITT = Intention-to-treat; GVH = Gastric variceal hemorrhage; UGI = Upper gastrointestinal; EIS = Endoscopic Injection Sclerotherapy.Primary outcomes and inclusion criteria are presented as reported in the original publications.

Supplementary Table 4 Prevalence of Cirrhosis, Non-Cirrhotic Portal Hypertension, and Ascites in Included Studies

Study	**Cirrhosis (%)**	**Non-Cirrhotic Portal Hypertension (%)**	**Ascites Present (%)**
Lo *et al*. (2001)	100% (60/60)	0%	53.3% (32/60)
Tan *et al*. (2006)	100% (97/97)	0%	52.6% (51/97)
Zheng *et al*. (2006)	100% (58/58)	NR	NR
Amin *et al*. (2010)	100% (150/150)	0%	NR
Luo *et al*. (2011)	NR	NR	NR
Hassan *et al*. (2018)	100% (60/60)	0%	NR
Shi *et al*. (2025)	NR	NR	NR

Note: Data are presented as percentage (number/total) where available. **NR:** Not reported. **GOV:** Gastroesophageal varices; **IGV:** Isolated gastric varices. For **Zheng *et al.*** and **Hassan *et al.*,** the study methods explicitly stated that all included patients had liver cirrhosis, though individual patient data were not tabulated. **Amin *et al.*** reported Child-Pugh scores implying the presence of ascites but did not provide the exact number of patients with ascites.