Supplementary Table 1. Committee for the Development of Clinical Practice Guidelines for Percutaneous Endoscopic Gastrostomy

Title	Name	Institution	Comments
Team leader	Moon Kyung Joo	Korea University College of Medicine	
Co-secretary	Chung Hyun Tae	Ewha Womans University College of Medicine	
Co-secretary	Ju Yup Lee	Keimyung University School of Medicine	
Member	Chan Hyuk Park	Hanyang University College of Medicine	
Member	Eun Jeong Gong	Hallym University College of Medicine	
Member	Cheol Min Shin	Seoul National University Bundang Hospital	
Member	Hyun Lim	Hallym University College of Medicine	
Member	Hyuk Soon Choi	Korea University College of Medicine	
Member	Sang Hoon Kim	Dongguk University Ilsan Hospital	Korean College of *Helicobacter* and Upper Gastrointestinal Research–Metabolism, Obesity & Nutrition Research Group
Member	Chul Hyun Lim	College of Medicine, The Catholic University of Korea	Korean Society of Gastrointestinal Endoscopy-The Research Group for Endoscopes and Devices
Consultant	Miyoung Choi	National Evidence-based Health Care Collaborating Agency	Expert methodologist

Supplementary Table 2. Summary of Evidence for Prophylactic Antibiotics

First author	Publication year	Country	Study period	Population (adults vs children)	Major indications for PEG	Number of participants	PEG method	IV antibiotics	Control	Follow-up, day	Antibiotics-related adverse event (n)
Jonas	1985	USA	1982–1984	NA	Swallowing dysfunction, head and neck cancer	33	Pull	Cefoxitin	Placebo	≥4	NA
Jain	1987	USA	1984– 1986	NA	Swallowing dysfunction, oropharyngeal cancer	55	Pull	Cefazolin	Placebo	2 - 7	NA
Akkersdijk	1995	Netherlands	NA	NA	Swallowing dysfunction, oropharyngeal cancer	69	Pull	Amoxicillin/ Clavulanic acid	No antibiotics	30	NA
Sturgis	1996	USA	1994– 1995	NA	Neurological diseases, malignancy	61	Pull	Cefazolin	Placebo	7	NA
Gossner	1999	Germany	1993– 1995	NA	Swallowing dysfunction, obstruction	307	Pull	Cefotaxime or Piperacillin/ Tazobactam	No antibiotics	7	NA
Preclik	1999	Germany	NA	Adults	Swallowing dysfunction, oropharyngeal or esophageal caner	84	Pull	Amoxicillin/ Clavulanic acid	Placebo	≥7	Antibiotics group: nausea (1), seizure (1) Placebo group: vomiting (1), suspected allergic exanthema (1)
Dormann	2000	Germany	NA	Adults	Swallowing dysfunction, malignancy	216	Pull	Ceftriaxone	No antibiotics	10	NA
Panigrahi	2002	UK	NA	Adults	Swallowing dysfunction, malignancy	58	Pull	Amoxicillin/ Clavulanic acid	Placebo	7, 28	NA
Ahmad	2003	UK	NA	Adults	Swallowing dysfunction, oropharyngeal cancer	66	Pull	Cefuroxime	Placebo	7	Antibiotics group: *C. difficile*-associated diarrhea (3) Placebo group: *C. difficile*-associated diarrhea (0)
Saadeddin	2005	UK	2001– 2003	Adults	Swallowing dysfunction	83	Pull	Amoxicillin/ Clavulanic acid	Placebo	≥7	NA
Radhakrishnan	2006	UK	1999– 2004	NA	Swallowing dysfunction	62	Pull	Cefuroxime	No antibiotics	7	NA
Shastri	2008	Germany	2003– 2007	NA	Malignancy	93	Push	Ceftriaxone	Placebo	7	NA
Adachi	2016	Japan	2009– 2013	NA	Swallowing dysfunction	90	Push	Ampicillin/ Sulbactam	Placebo	7	NA
Alessandri	2021	Italy	2014– 2019	Children	Swallowing dysfunction	49	Pull	Amoxicillin/ Clavulanic acid	Placebo	14	Antibiotics group: none Placebo group: none

NA, not applicable; *C. difficile*, *Clostridium difficile*.

Supplementary Table 3. Summary of Evidence for Timing of Feeding

First author	Publication year	Country	Study period	Study design	Definition		Number of participants		Follow-up, day	Adverse events. No. (%)	Mortality within 72 hr, No. (%)	Significant increase of residual volume, No. (%)
					Early feeding	Late feeding	Early feeding	Late feeding				
Brwon	1995	USA	NA	RCT	<3 hr	Next day	27	30	>14	5 (8.8)	0	NA
Choudhry	1996	USA	1993.11–1995.4	RCT	<3 hr	After 24 hr	21	20	3	3 (7.3)	1 (2.4)	3 (7.3)
Unni	1996	USA	NA	RCT	<3 hr	After 24 hr	10	10	1	0	NA	0
McCarter	1998	USA	NA	RCT	<4 hr	After 24 hr	57	55	30	12 (10.7)	1 (0.9)	19 (17.0)
Stein	2002	Germany	1997.1–1997.12	RCT	<1 hr	After 24 hr	40	40	3	12 (15.0)	5 (6.3)	24 (30.0)

NA, not applicable; RCT, randomized controlled trial.

Supplementary Table 4. Summary of Evidence for Type of Gastrostomy Tube (Patients without Upper Aerodigestive Tract Cancers)

First author	Publication year	Country	Study period	Study design	Major indications for PEG	Number of participants	Pull method	Push method	Success rate		Complication rates	
									Pull method	Push method	Pull method	Push method
Ohno	2015	Japan		Observational		113	22	91				
Retes	2017	Brazil	2008.12–2013.10	Observational	Head and neck cancer	309	172	137	NA	NA	Early: 13 (7.6%) Late: 42 (24.4%)	Early: 5 (3.6%) Late: 40 (29.2%)
Dyck	2011	Belgium	2006–2008	Observational	Head and neck or esophageal malignancies	57	33	24	33 (100%)	20 (83%)	Early: 4 (12%) Mortality: 0 (0%)	Early: 11 (48%) Mortality: 2 (8%)
Tucker	2003	USA	1999–2001	Observational	Head and neck cancer	79	50	29	NA	NA	15 (30%)	0 (0%)
Kohler	2015	Austria	2009–2012	Observational		231	131	100			Overall complication rate: 28 (21.4%) Dislocation of the tube: 5 (3.8%) Occlusion of the PEG: 1 (0.8%)	Overall complication rate: 33 (33%) Dislocation of the tube: 12 (12%) Occlusion of the PEG: 10 (10%)
Campoli	2012	Brazil		Meta-analysis		2,336 from 6 comparative and 10 observational studies			NA	NA	Comparative studies: Infection OR: 13.0 (95% CI: 4.6-36,8, pull method vs introducer method) Observation studies 10.7% (95% CI: 4.9%–21.8%)	Observation studies 0.9% (95% CI: 0.2%–4.5%)
Lee	2014	Korea	2009.1–2012.6.	Observational	Neurologic disease (58.7%), malignancy (21.7%), other indications (19.6%)	141	77	58	Overall success rate: 96.5% 1/77 (1.2%)	2/58 (3.4%)	29/71 (40.8%)	25/54 (46.3%)
Sartori	1996	Italy		Observational		80	39	41	100%	100%	1/39 (2.6%)	1/41 (2.4%)
Maetani	2003	Japan	1999.9–2002.5	Observational	Patients with dysphagia	58	29	29	100%	100%	Peristomal infection: 9 (31.0%)	Peristomal infection: 0 (0%)
Pih	2018	Korea	2005–2015	Observational		411	139	262	NA	NA	30-day mortality: 8 (5.8%)	30-day mortality: 12 (4.6%)

PEG, percutaneous endoscopic gastrostomy; NA, not applicable; OR, odds ratio; CI, confidence interval.

Supplementary Table 5. Summary of Evidence for Type of Gastrostomy Tube (Patients with Upper Aerodigestive Tract Cancers)

First author	Publication year	Country	Study period	Population (adults vs children)	Major indications for PEG	Number of participants	Pull method	Push method	PEG metastasis rates	
									Pull method	Push method
Siu	2020	USA	to 2019	Adults (age ≥18 yr)	UADT malignancies	10,388 from 98 Studies	7,887	2,501	0.56% (95% CI: 0.40%–0.79%)	0.29% (95% CI: 0.15%–0.55%)
Fung	2017	USA	1/5/2009–12/22/2014	Adults	Head and neck malignancy	777	777	-	5 (1 stromal metastasis, 4 radiologically detected either on CT or PET)	-

PEG, percutaneous endoscopic gastrostomy; UADT, upper aerodigestive tract; CI, confidence interval; CT, computed tomography; PET, positron emission tomography.

Supplementary Table 6. Summary of Evidence for Endoscopic Treatment of Buried Bumper Syndrome

First author	Year	Country	Study period	Study design	Number of participants	Comparison	Main outcome
Casper	2018	Germany	2000–2015	Retrospective and prospective cohort	Retrospective 25, prospective 4	NA	Patients with partial buried bumper syndrome were effectively treated by endoscopy in both cohorts (24/25 and 4/4 patients respectively). For complete buried bumper syndrome (Cyrany grade 3) success rates of endoscopic therapy differed significantly between the cohorts (p=0.017).
Mueller-Gerbes	2017	Germany	2002–2013	Retrospective cohort	82	Bougie, grasp, needle-knife, papillotome	No AEs were observed in 70 patients (85.4%). Bleeding occurred in seven patients (31.8%) after cutting with a needle-knife papillotome and in one patient (8.3 %) after grasping. No bleeding was recorded after using a standard papillotome or a bougie (p<0.05). Ten of 22 patients (45.5%) treated with the needle-knife had a serious AE and one patient died (4.5 %).
El Ali	2011	Belgium	2002–2009	Retrospective cohort	879	NA	Only eight patients (8/879; 0.9%) developed BBS. Five patients underwent successful treatment with Cruciform mucosal incisions with needle-knife. No complications were observed
Dowman	2015	UK	2009–2013	Retrospective	58	Corflo vs Freka PEG tube	Increased risk of buried bumper syndrome with Freka PEG tubes when compared to Corflo PEG tubes.

NA, not applicable; AE, adverse event; BBS, buried bumper syndrome; PEG, percutaneous endoscopic gastrostomy.

Supplementary Table 7. Summary of Evidence for Replacement of Gastrostomy Tube

First author and year	Country	Study period	Study design	Timing of replacement	Number of participants	Number of total replacements	Tube type	Method of replacement	Number of routine or short interval replacements	Number of on-demand or long interval replacements	Main outcomes	Comparison (routine vs on-demand)
Nishiwaki 2011	Japan	2000–2010	Retrospective	Routine replacement (4–8 mo) or on-demand	317	1,092	Internal bloster	Percutaneous traction	1,070	22	13 complications associated with replacement (1.2%): fistular disruption: 8 (0.7%), hemorrhage: 4 (0.4%): device breakage: 1 (0.1%)	No differences in complications between routine and on-demand replacement (data not presented)
Lee 2013	Korea	2008–2012	Retrospective	Routine replacement or on-demand	330	N/A	Internal bloster	Percutaneous (154), endoscopic (176)	264	66 (37: PEG site infection, 14: leakage)	1) Immediate complication 16 (4.8%): laceration 13 (3.9%); bleeding 2 (0.1%), perforation 1 (0.03%). 2) Late complications 8 (2.4%): infection 5 (1.5%), leakage 3 (0.95)	Short interval of replacement (≤6 mo) shows higher mechanical complication than long interval (>6 mo): 11 (6.3%) vs 3 (1.9%)
Jo 2014	Korea	2009–2014	Retrospective	On-demand	72 (30: displacement, 22: obstruction, 10: leakage, 8: PEG site infection)	NA	Internal bloster	NA	57 (early replacement)	15 (late replacement)	The "early exchange" group had a lower BMI than "late exchange" group (19.7±3.57 vs 22.4±3.87). Reason of replacement was not different between two groups.	Replacement associated complications were not analyzed between the two groups (Reason of replacement is analyzed).
Lisotti 2019	Italy	2016–2018	Prospective cohort	Routine replacement or on-demand	99	234	Balloon type	NA	203	31	Among 203 elective tube placements, 197 (97.0%) have been performed at home. No adverse events were reported.	Comparison between routine vs on-demand replacement was not presented.
Sbeit 2021	Israel	Not presented	Retrospective	On-demand	48 (leak: 20, obstruction: 10, dislodgement: 18)	NA	Bumper type or balloon type	NA	22	26	No difference of PEG-related long-term complication (leak: 8/22 vs 12/26, p=0.057; obstruction: 5/22 vs 5/26, p=0.72; dislodgement: 9/22 vs 9/26, p=0.76) between replacement within 6 vs beyond 6 mo.	Replacement associated complications are not presented between two groups (Reason of replacement is analyzed).

PEG, percutaneous endoscopic gastrostomy; BMI, body mass index; NA, not applicable.

Supplementary Table 8. Summary of Evidence for Removal of Gastrostomy Tube Using "Cut-and-Push" Technique

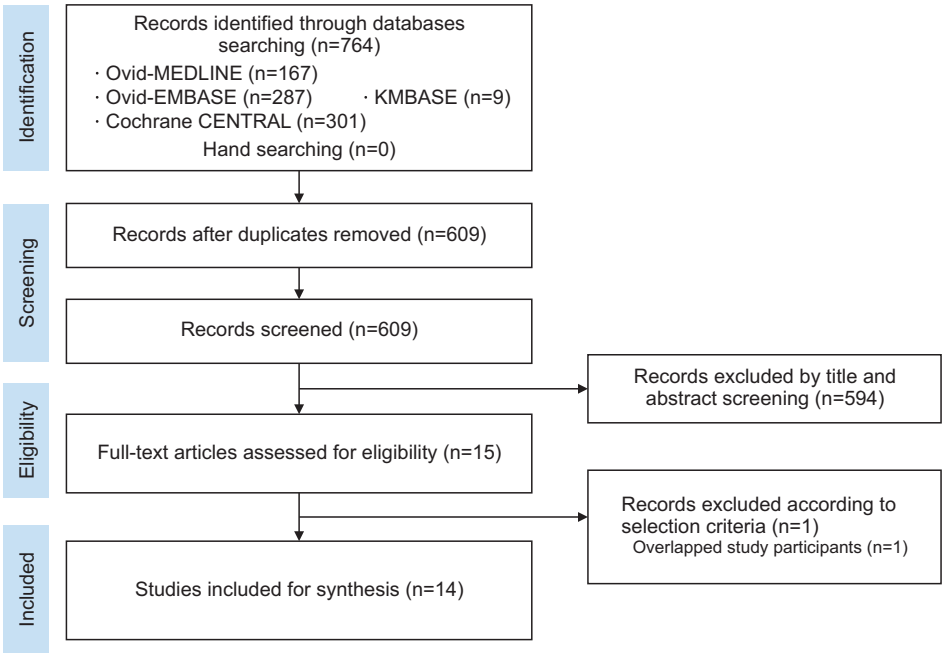
First author	Year	Country	Study period	Study design	Number of participants	Type of tube	Number of "cut and push" method	Number of endoscopic removal	Follow-up protocol	Follow-up duration	Main results	Comparison between "cut and push" technique vs endoscopic removal
Korula	1991	USA	1988–1990	Prospective cohort	64	Internal bloster (size not presented)	63	1	Radiographs of abdomen on 7 to 14 day after tube placement	4–200 day	Radiograph was taken in 57: complete elimination of tube: 84% (48/57), tube in colon: 14% (8/57) → one in stool. Radiograph was not taken in 14: one in stool. Tube retention and additional endoscopic removal in one patient (1.6%, 1/63)	NA
Pearce	2000	UK	1995–1999	Retrospective	80	9–15 F	73	7	No routine radiographs	Not presented	Two (2.7%) complications in "cut and push" group: stuck in abdominal wall, abdominal pain	NA (complication of endoscopic removal was not presented)
Merrick	2008	UK	Not presented	Prospective cohort	42	Internal bloster, 15 F	42	0	Radiographs of abdomen on day 7 and 14 after tube placement	7–14 day	41 (97.6%) passed the remnant by day 8 and all by day 14. No adverse events occurred.	NA
Kejariwal	2009	UK	2002–2007	Retrospective	89	Internal bloster, 15 F	89	0	No routine radiographs	26.8 mo (1–66)	No minor and major complications	NA
Agha	2013	Italy	2009–2011	Prospective cohort	79	Internal bloster, 20 F (57), 24 F (22)	79	0	No routine radiographs	Up to 12 mo	74 (93.6%) tubes passed through the intestine within 7 day. No serious complications were reported.	NA

NA, not applicable

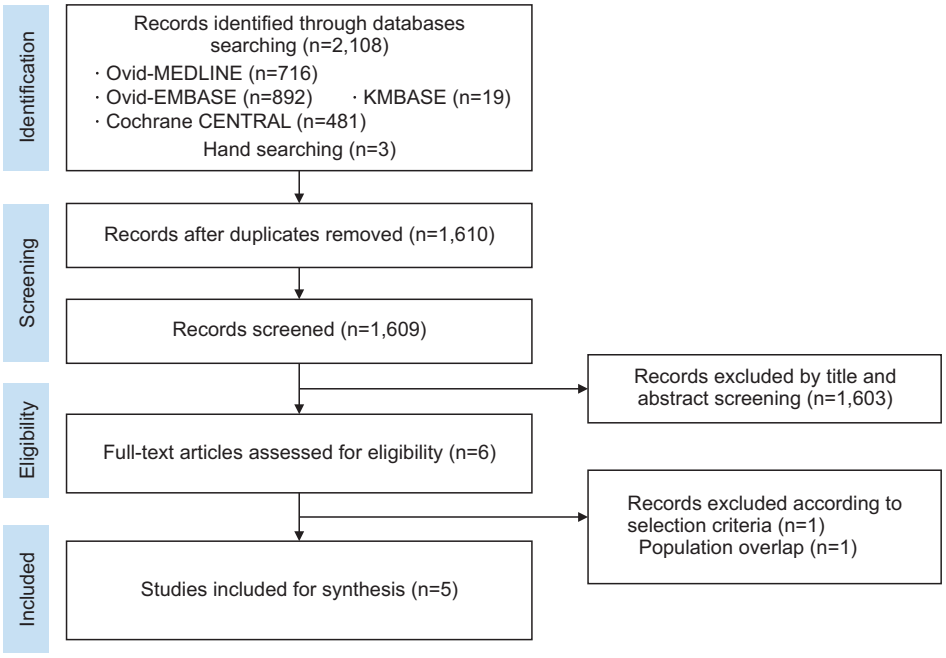
Supplementary Table 9. Summary of Evidence for Effects of CO_2 Gas

First author	Year	Country	Study period	Study design	Number of participants	Comparison	Main outcome
Allen	2017	Georgia	2015–2016	Retrospective	257	Desufflation vs no desufflation	PNP rate on POD1 in CXR: Desufflation group 14.8%, no desufflation group 7.9%, p>0.05.
Murphy	2016	USA	2012–2014	Prospective, double-blind Randomized trial	35	CO_2 vs air	PNP 2/14 (14.3 %) using CO_2 and 8/15 (53.3 %) using ambient air (p=0.05). No significant difference in abdominal distention, VAS scores for pain or bloating between CO_2 and ambient air.
Nishiwaki	2012	Japan	2009–2011	Comparative Study Randomized controlled trial	60	CO_2 vs air	PNP was observed only in the air group but not in the CO_2 group (p=0.003). The evaluation of bowel distension on abdominal X ray revealed a significant decrease of small bowel distension in the CO_2 group compared to the air group (p<0.001) at 10 min and 24 hr after PEG, whereas there was no significant difference in large bowel distension between the two groups.
Gottfried	1986	USA	1982–1983	Observational	24	NA	Nine patients (38%) developed radiologic PNP. Five patients (21%) had gross evidence of PNP, three patients had more subtle findings of small amounts of free air, and one patient had free air found by CT scan. No patient developed signs or symptoms of peritoneal inflammation.

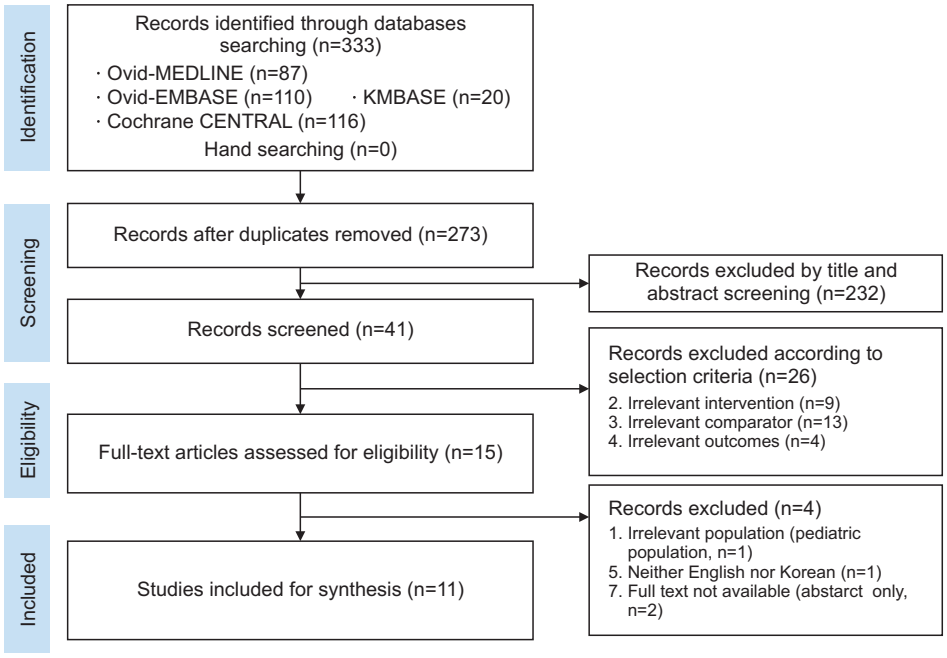
PNP, pneumoperitoneum; POD, postoperative day; CXR, chest X-ray; VAS, visual analog scale; PEG, percutaneous endoscopic gastrostomy; CT, computed tomography; NA, not applicable.



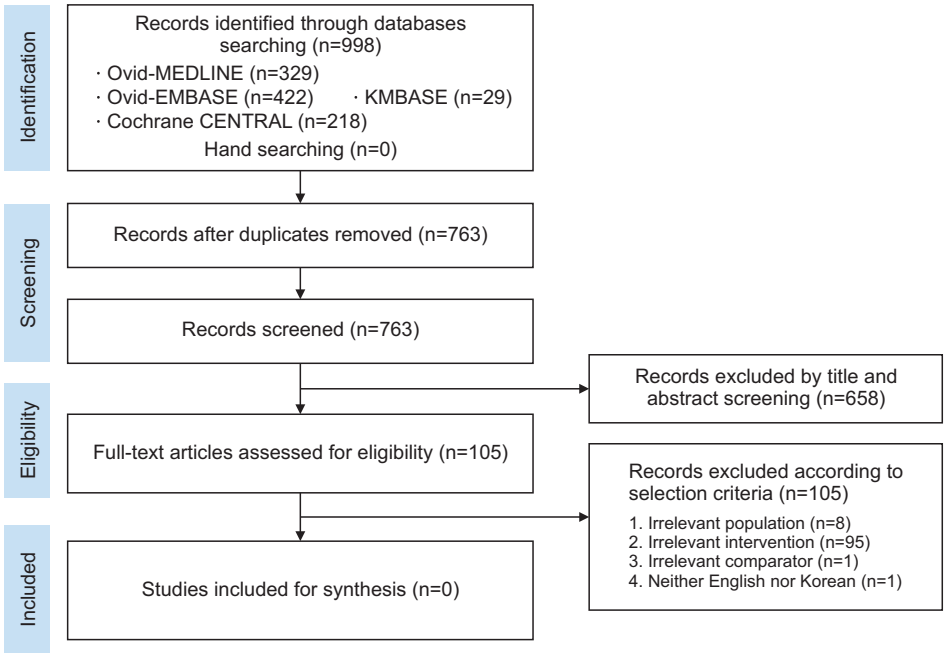
Supplementary Fig. 1. PRISMA flow diagram of prophylactic antibiotic use.



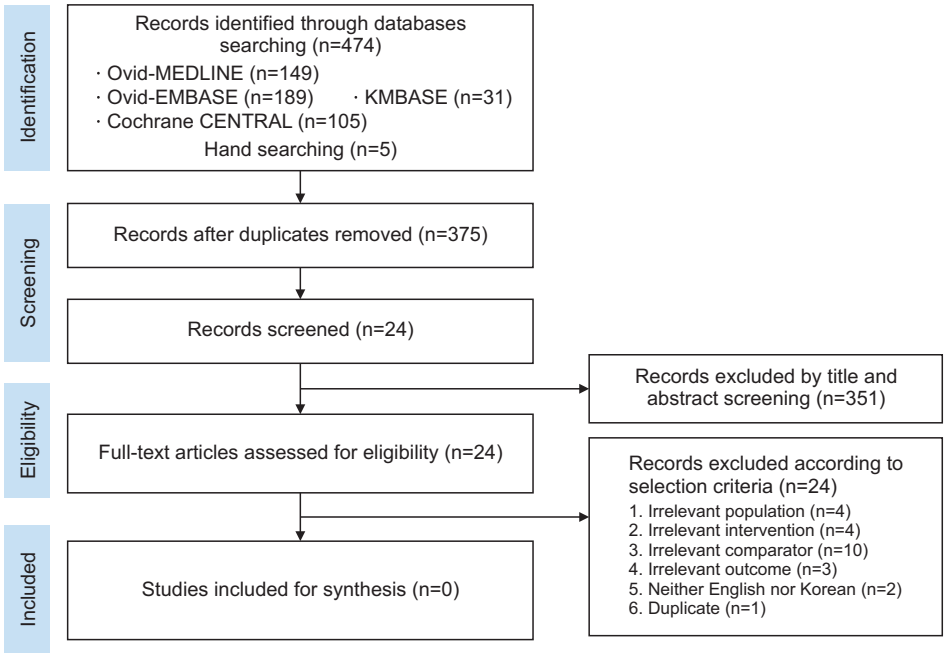
Supplementary Fig. 2. PRISMA flow diagram of feeding timing.



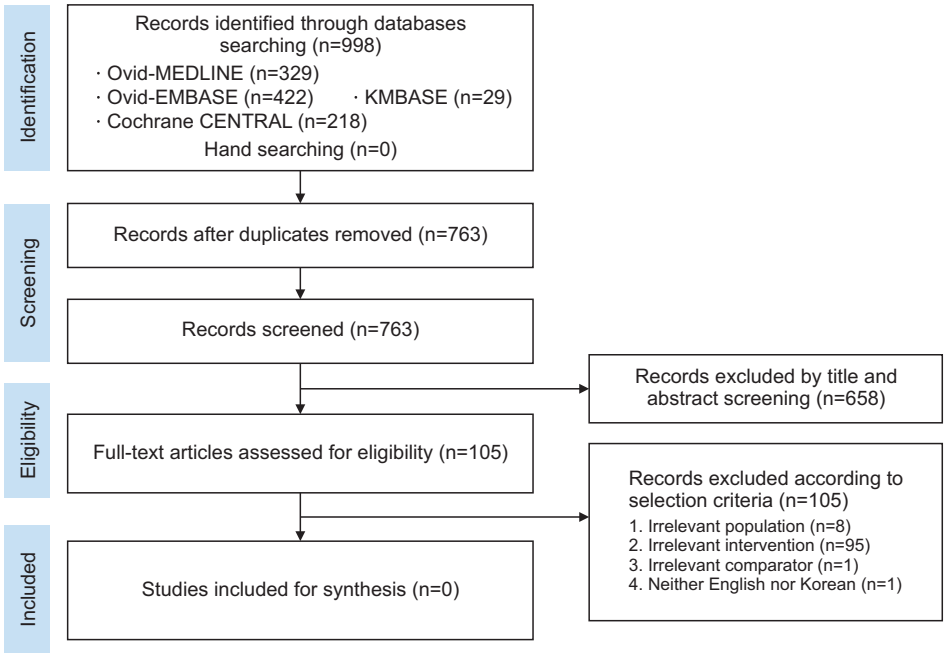
Supplementary Fig. 3. PRISMA flow diagram of percutaneous endoscopic gastrostomy techniques.



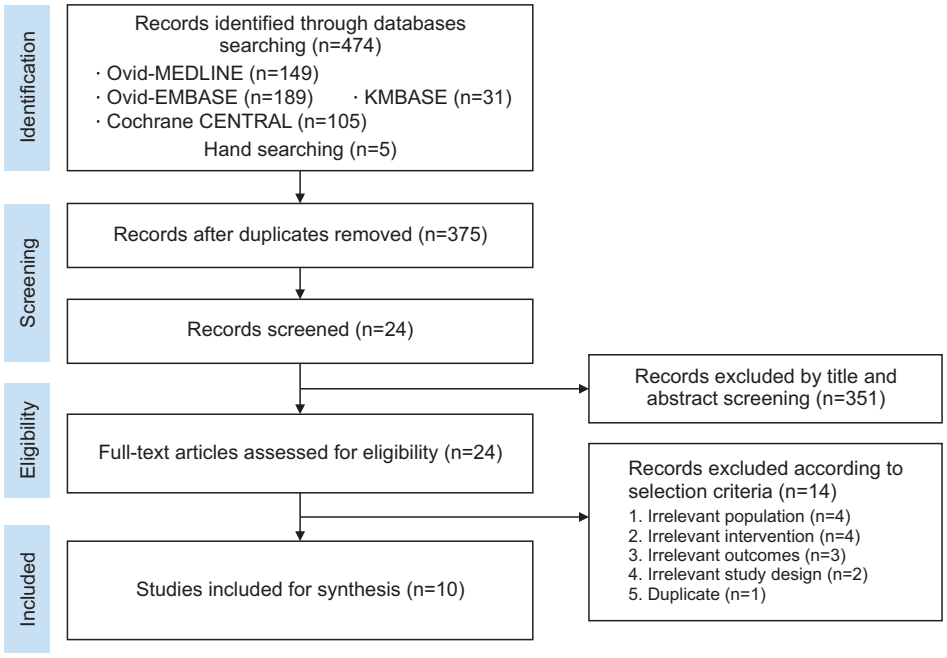
Supplementary Fig. 4. PRISMA flow diagram of peristomal leakage.



Supplementary Fig. 5. PRISMA flow diagram of gastrostomy tube breakage, occlusion, dislodgement, or degradation.



Supplementary Fig. 6. PRISMA flow diagram of the management of adverse events.



Supplementary Fig. 7. PRISMA flow diagram of replacement or removal of gastrostomy tube.