

The beneficial effects of the transanastomotic feeding tube in the management of congenital duodenal obstruction: a meta-analysis

Los efectos beneficiosos de la sonda de alimentación transanastomótica en el tratamiento de la obstrucción duodenal congénita: un metanálisis

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Abstract

Objective: We aimed to assess the evidence on the efficacy and safety of transanastomotic feeding tubes (TAFTs) in neonates with congenital duodenal obstruction (CDO), we conducted a systematic review. **Material and methods:** Using the databases EMBASE, PubMed, and Cochrane, we carried out a thorough literature search up to 2022. Studies comparing TAFT + and TAFT - for CDO were included. We applied a random effect model. **Results:** 505 CDO patients who met the inclusion criteria were selected. The TAFT + group had a shorter time to reach full feeds (weighted mean difference [WMD]: -6.63, 95% confidence interval [CI]: -8.83 - -4.43; $p < 0.001$) and had significantly less central venous catheter (CVC) insertion ($I^2 = 85\%$) (RR: 0.43, 95% CI: 0.19-1.00; $p < 0.05$). Fewer patients in the TAFT + group received parenteral nutrition (PN) ($I^2 = 78\%$) (RR: 0.43, 95% CI: 0.20-0.95; $p < 0.05$). There was no statistically significant difference in terms of the development of sepsis ($I^2 = 37\%$) (risk ratio [RR]: 1.35, 95% CI: 0.52-3.46; $p > 0.05$). No statistically significant difference was observed in terms of length of stay ($I^2 = 82\%$) (WMD: 2.22, 95% CI: -7.59-12.03; $p > 0.05$) and mortality ($I^2 = 0\%$) (RR: 0.55, 95% CI: 0.07-4.34; $p > 0.05$). **Conclusions:** The use of the transanastomotic tube resulted in early initiation of full feeding, less CVC insertion, and less need for PN.

Keywords: Congenital duodenal obstruction. Feed strategy. Parenteral nutrition. Transanastomotic tube.

Resumen

Objetivo: Nuestro objetivo fue evaluar la evidencia sobre la eficacia y seguridad de TAFT en recién nacidos con CDO, realizamos una revisión sistemática. **Material y Métodos:** Utilizando las bases de datos EMBASE, PubMed y Cochrane, realizamos una búsqueda bibliográfica exhaustiva hasta 2022. Se incluyeron estudios que compararan TAFT + y TAFT - para CDO. Aplicamos un modelo de efectos aleatorios. **Resultados:** Se seleccionaron 505 pacientes con ODC que cumplían con los criterios de inclusión. El grupo TAFT + tuvo un tiempo más corto para alcanzar la alimentación completa (DMP -6.63, IC del 95 %: -8.83 a -4.43; $p < 0.001$) y tuvo una inserción de CVC significativamente menor. Menos pacientes en grupo TAFT + recibieron NP ($I^2 = 78\%$) (RR: 0.43, IC del 95%: 0.20 a 0.95; $p < 0.05$). No hubo diferencia estadísticamente significativa en cuanto al desarrollo de sepsis. No se observaron diferencias estadísticamente significativas en cuanto a la duración de la estancia ($I^2 = 82\%$) (DMP 2.22, IC del 95 %: -7.59 a 12.03; $p < 0.05$) y mortalidad ($I^2 = 0\%$) (RR: 0.55, IC del 95 % 0.07 a 4.34; $p > 0.05$). **Conclusiones:** El uso de la sonda transanastomótica resultó en el inicio temprano de la alimentación completa, menor inserción de CVC y menor necesidad de NP.

Palabras clave: Obstrucción duodenal congénita. Estrategia de alimentación. Nutrición parenteral. Sonda transanastomótica.

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Date of reception: 08-10-2022

Date of acceptance: 22-10-2022

DOI: 10.24875/CIRUE.M22000589

Cir Cir (Eng). 2023;91(3):315-322

Contents available at PubMed

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Introduction

One of the most common intestinal obstructions in newborn babies is congenital duodenal obstruction (CDO)¹. Calder published the first work on the subject in 1733. Its frequency has been recorded between 1/6000 and 1/10000 in different series². According to reports, intensive pre-operative early follow-up of persons with duodenal obstruction and qualified neonatal intensive care methods have dramatically reduced the morbidity and mortality of the disease³. In contrast, problems remain with a baby who starts feeding later. It has been reported for years that sepsis is inevitable in a baby who cannot be fed⁴. In recent years, in particular, some surgical procedures for repairing duodenal atresia have been proposed⁵. The placement of a transanastomotic feeding tube (TAFT) is one of the attractive treatments during the repair of duodenal atresia. In several recent studies, placement of a transanastomotic tube has been associated with early feeding and a reduced risk of sepsis⁶. To assess the evidence on the efficacy and safety of TAFT in neonates with CDO, we conducted a systematic review.

Methods

Search strategy

Using the databases Embase, PubMed, and Cochrane, we carried out a thorough literature search up to 2022. CDO, duodenal atresia, and annular pancreas were the search phrases used. Furthermore, we searched also “duodenal web, annular pancreas, newborn, infant, surgery, parenteral nutrition (PN), post-operative care, transanastomotic tube, and enteral feeding”. References and reviews were searched manually for further relevance.

Study selection

Studies comparing TAFT + and TAFT - for CDO were included in the study. Inclusion criteria: (1) clinical studies comparing TAFT + versus TAFT - for CDO and (2) raw data including some of the following: Time to reach full feeds, PN, anastomotic leakage, sepsis, need for central venous catheter (CVC) insertion, mortality, and length of hospital stay. Exclusion criteria: (1) No comparative case series as control and (2) studies could not provide usable raw data or duplicate publications.

Data extraction

Two authors independently reviewed the included studies (SA and MA). We extracted information on sample size, study design, and year of publication. Population data were obtained, including birth weight, age at surgery, type of tube, type of feed, and associated anomaly.

Risk of bias assessment

The risk of bias in the included studies was evaluated using the risk of bias in the Non-randomized Studies—of Interventions (ROBINS-I) method. The reviewers also evaluated the overall risk of bias across all studies for each relevant outcome and considered that information when making decisions about the “quality of evidence.”

Statistical analysis

The Review Manager (RevMan) software version 5.4 was applied for statistical data analysis. Measured mean differences and risk ratios were used to evaluate continuous and dichotomous variables. The I^2 statistic was employed to quantify the amount of statistical heterogeneity, and the Chi-square test was utilized to determine it. Significance was set at $p < 0.05$. We applied a random effect model.

Reporting

Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) was used to report the findings of this systematic review.

Results

Using a PRISMA flow diagram, figure 1 presents an overview of the selection procedure. Forty studies identified during the initial search strategy were retrieved for full-text review, and 9 studies⁶⁻¹⁴ with 505 CDO patients (223 TAFT and 282 non-TAFT) who met the inclusion criteria were selected.

Risk of bias

Table 1 provides a summary of the ROBINS-I tool's risk of bias evaluation. A “severe” or “critical” risk of bias existed in three articles with regard to “Bias due to confounding.” Given their retrospective character, all studies had a “moderate” risk of bias in the other categories.

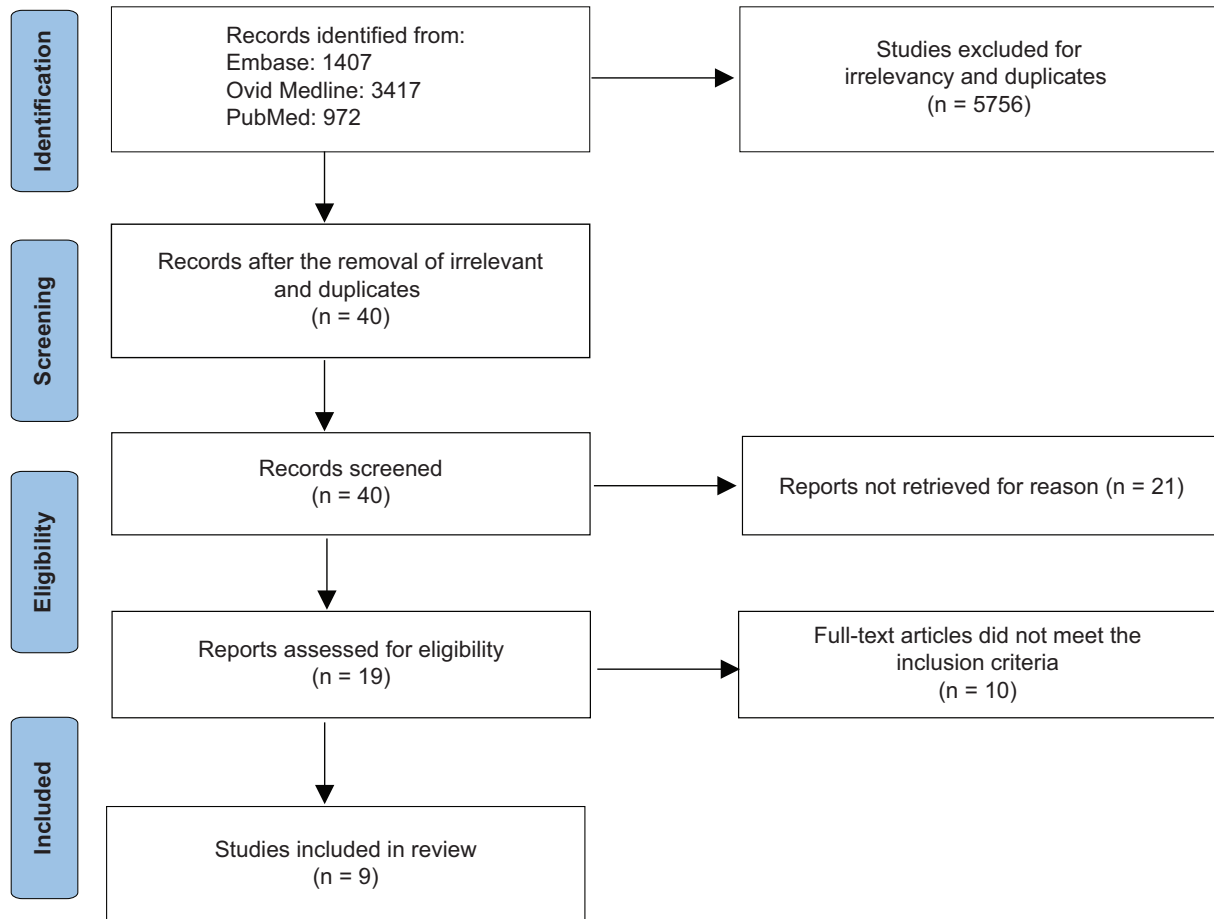


Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analysis flow diagram of study selection.

Outcomes

TIME TO REACH FULL FEEDING

Although seven trials documented time to full feeding, only five studies were suitable for meta-analysis. No statistically significant difference was found between TAFT+ and TAFT- in terms of the time to full feeding, according to meta-analysis ($I^2 = 93\%$) (weighted mean differences [WMD]: -1.43 , 95% confidence interval [CI]: -8.43 - 5.58 ; $p > 0.05$; Fig. 2). However, the TAFT group's time to reach full feeds was dramatically reduced when the high bias studies were taken out of the equation ($I^2 = 0\%$), (WMD: -6.63 , 95% CI: -8.83 - 4.43 ; $p < 0.001$; Fig. 3).

CVC insertions

Five studies have discussed CVC insertion. The TAFT + group had significantly less CVC insertion ($I^2 = 85\%$), (risk ratio [RR]: 0.43 , 95% CI: 0.19 - 1.00 ; $p < 0.05$; Fig. 4).

PN

Although there was no statistically significant difference in the duration of PN ($I^2 = 80\%$) (WMD: -2.02 , 95% CI: -7.36 - 3.33 ; $p > 0.05$; Fig. 5), fewer patients in the TAFT + group received PN ($I^2 = 78\%$) (RR: 0.43 , 95% CI: 0.20 - 0.95 ; $p < 0.05$; Fig. 6).

Anastomotic leakage

Anastomotic leakage was not significantly different across the groups ($I^2 = 0\%$) (RR: 2.81 , 95% CI: 0.50 - 15.90 ; $p > 0.05$; Fig. 7).

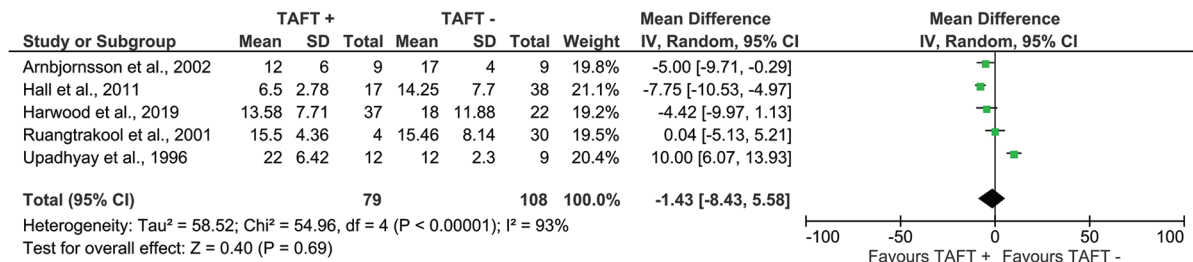
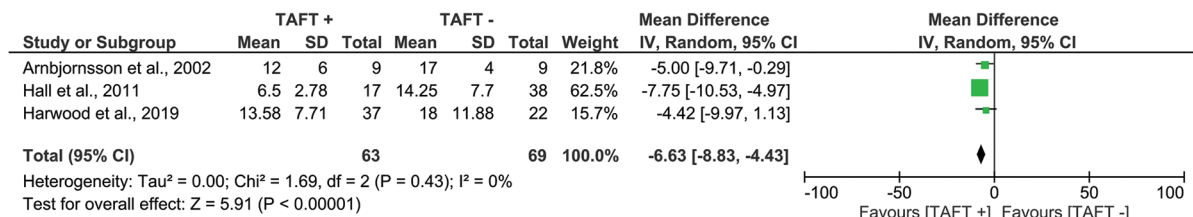
Sepsis

Sepsis was interpreted in five studies. Between the two groups, there was no statistically significant difference in terms of the development of sepsis ($I^2 = 37\%$) (RR: 1.35 , 95% CI: 0.52 - 3.46 ; $p > 0.05$; Fig. 8).

Table 1. Risk of bias (ROBINS-I tool)

Author	Year	Bias due to confounding	Bias for other domains
Arnbjörnsson et al.	1987	Moderate: Integrated retrospective and prospective data. The selection criteria are confusing and not clearly stated.	Moderate
Bethell et al.	2020	Moderate: Difference in age at surgery	Moderate
Cresner et al.	2022	Moderate: Unclear study period	Moderate
Hall et al.	2011	Moderate: Both groups shared comparable fundamental traits	Moderate
Harwood et al.	2019	Moderate: Both groups shared comparable fundamental traits	Moderate
Mooney et al.	1987	Serious: Patients also received gastrostomy	Moderate
Ruangtrakool et al.	2001	Critical: Infant distribution differs between the two groups inequitably (4 vs. 30)	Moderate
Treider et al.	2022	Moderate: Lower weight in the No-TAFT group	Moderate
Upadhyay et al.	1996	Serious: Patients also received gastrostomy	Moderate

ROBINS-I: Risk Of Bias in Non-randomized Studies—of Interventions; TAFT: transanastomotic feeding tube.

**Figure 2.** Time to teach full feeds.**Figure 3.** Time to reach full feeds after excluding studies with a high risk of bias.

Length of stay

No statistically significant difference was observed in terms of length of stay in the hospital (I² = 82%) (WMD: 2.22, 95% CI: -7.59-12.03; p > 0.05; Fig. 9).

Mortality

All studies included in the meta-analysis discussed mortality. However, statistical data revealed that there

was no statistically significant difference between the groups (I² = 0%) (RR: 0.55, 95% CI: 0.07-4.34; p > 0.05; Fig. 10).

Discussion

This literature review is the largest meta-analysis, in which cases of CDO treated using the transanastomotic tube are analyzed and discussed in detail. Two hundred twenty-three newborns underwent

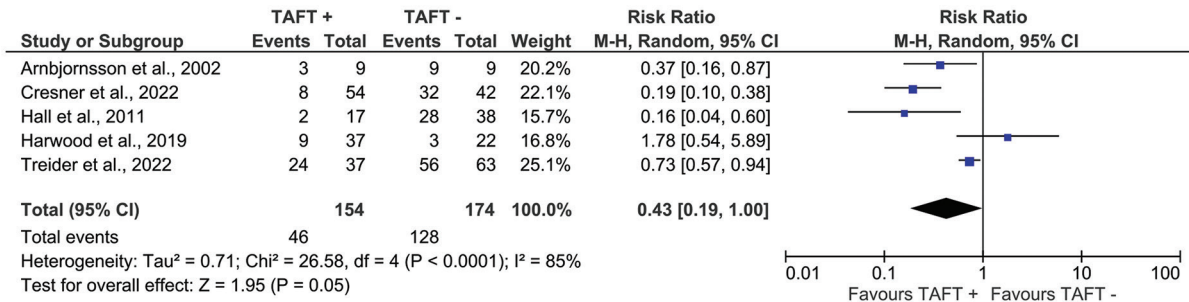


Figure 4. Central venous catheter insertion.

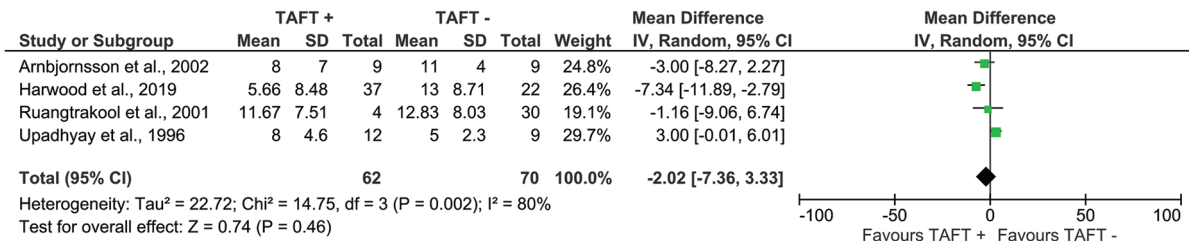


Figure 5. Duration of parenteral nutrition.

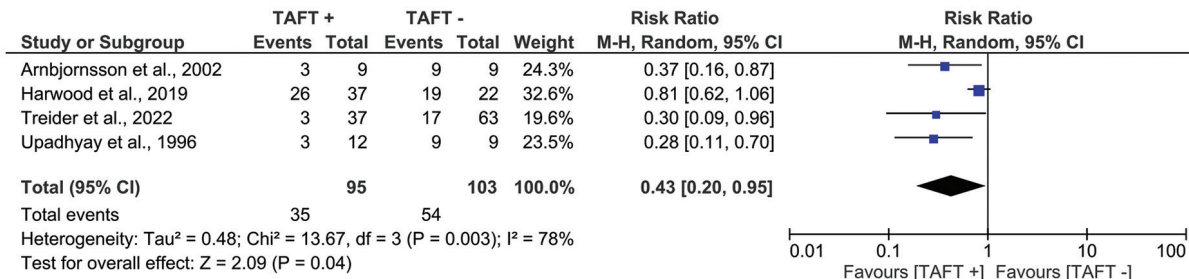


Figure 6. Number of patients who received parenteral nutrition.

intraoperative TAFT insertion in this comprehensive review, which include 9 observational trials, while 282 did not. Sepsis and death are caused by the traditional delayed commencement of enteral feeding. Early and trophic feeding has been demonstrated in several trials to decrease sepsis⁴. In this circumstance, TAFT use is crucial for early feeding in patients undergoing CDO surgery⁵. Upadhyay et al. reported time to reach full feeding on the 22nd day in the patients who placed TAFT and on the 12th day in the patients who did not¹⁴. Ruangtrakool et al. found similar results in both groups (time to reach full feeding on the 15th day)¹². However, the TAFT group's time to reach full feeds was dramatically reduced when these two high-bias studies^{12,14} were taken out of the equation. Similar outcomes were observed by Biradar et al.⁵.

Long-term malnutrition is an important problem in patients with CDO. This causes significant weight loss and accelerates the catabolic process¹⁵. CVC insertion is a recommended method for patients to feed parenterally to prevent weight loss. However, it is fact that TAFT, which has become popular recently, allows early feeding, earlier reaching the full feed. Therefore, TAFT is considered to reduce the need for CVC and PN⁵. This meta-analysis revealed that the TAFT+ group had significantly less CVC insertion and fewer patients in the TAFT + group received PN. Although PN duration was reported to be very short in an important study conducted in recent years⁶, no difference in the duration of PN was observed in our meta-analysis even when the high-bias studies were taken out of the equation.

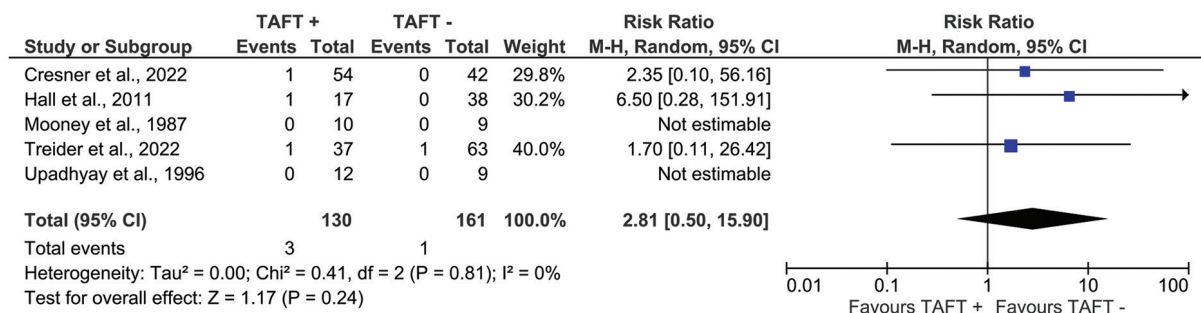


Figure 7. Anastomotic leakage.

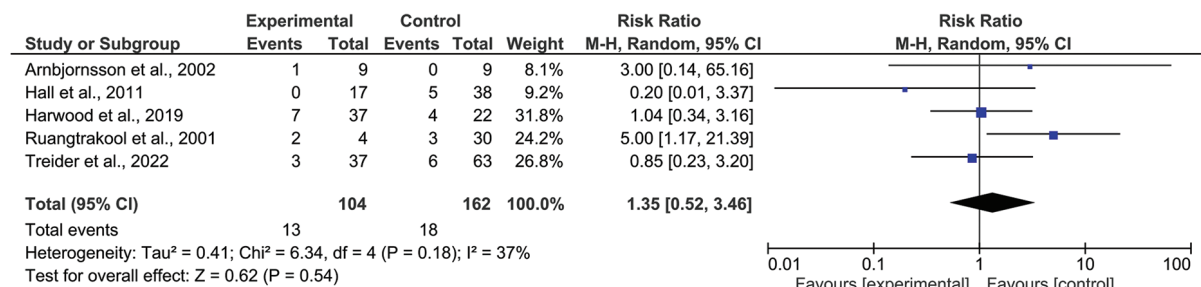


Figure 8. Sepsis.

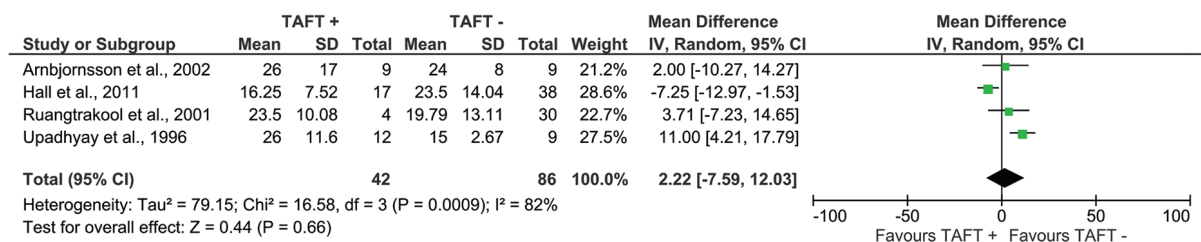


Figure 9. Length of stay in hospital.

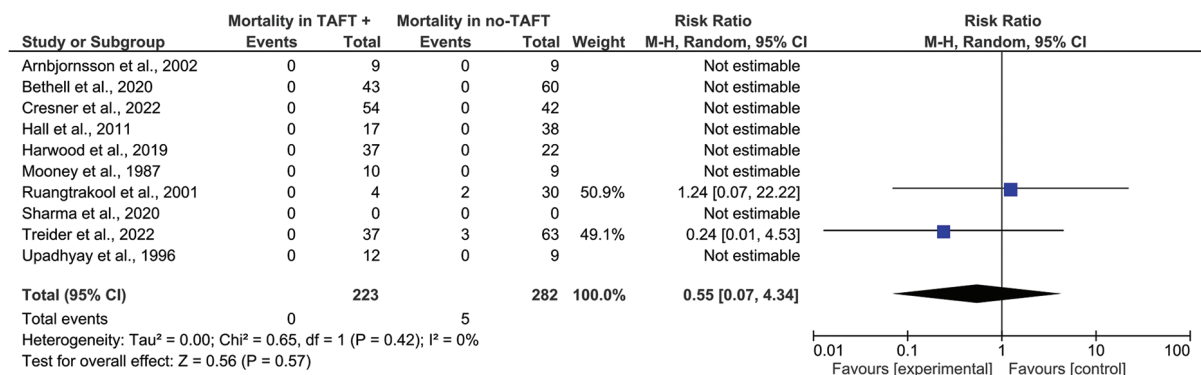


Figure 10. Mortality.

In three studies, anastomotic leakage was detected in a total of 4 patients (3 from the TAFT group and 1 from the no-TAFT group)^{9,10,13}. Due to the small number of observed leakage, the small number of patients in the cohort, and the fact that the studies were not randomized controlled prospective studies, it was exceedingly challenging to predict what the real cause of the anastomotic leak was. However, anastomotic leakage was not significantly different across the groups ($I^2 = 0\%$) (RR: 2.81, 95% CI: 0.50-15.90; $p > 0.05$). Well-designed randomized controlled prospective studies may be a benefit to predict it.

Long-term fasting can cause mucosal atrophy, decreased intestinal enzyme expression, and altered peristalsis, all of which can increase the body's resistance to enteral feeding^{16,17}. Neonatal patients with surgical problems may fare much better if enteral feeds are started and advanced earlier in the post-operative period^{18,19}. Otherwise, sepsis will manifest; if the circumstance worsens, the septic situation may become more severe²⁰. On the contrary, the fed patient recovers more quickly and sepsis diminishes. While there was no sepsis observed in the TAFT + group, Hall et al. found 13% sepsis in the TAFT – group¹⁰. Although the TAFT+ group had significantly better results in this meta-analysis in terms of early feeding initiation and early attainment of full nutrition, there was no discernible difference between the two groups in terms of the proportion of patients who developed sepsis.

It was determined that patients with CDO who were treated with the laparoscopic method and patients who started early feeding and reached full nutrition in the early period were discharged early^{21,22}. In the study of Zhang et al., among the 1348 neonatal participants with CDO in the ten studies, 304 received laparoscopic surgery (LS) and 1044 received open surgery (OS). When compared to the OS approach, the LS approach resulted in shorter hospital stays and faster time to initial and full feeding²². In this study, no statistically significant difference was observed in terms of length of stay in the hospital ($I^2 = 82\%$) (WMD: 2.22, 95% CI: -7.59-12.03; $p > 0.05$). However, the number of patients in this area was limited. Well-designed RCTs with a larger number are needed in this area.

Central catheter application and secondary vascular problems; PN and cholestasis after PN; delayed feeding, mucosal atrophies secondary to late feeding, and accelerated sepsis; TAFT application and anastomotic leakage, which is likely to develop secondary to it, is a condition known to be a separate risk factor for

mortality^{5,21,22}. All studies included in the meta-analysis discussed mortality. While no mortality occurred in the TAFT + group, there were 5 deaths in the TAFT - group. However, statistical data revealed that there was no statistically significant difference between the groups ($I^2 = 0\%$) (RR: 0.55, 95% CI: 0.07-4.34; $p > 0.05$).

Conclusions

The use of the transanastomotic tube resulted in early initiation of full feeding, less CVC insertion, and less need for PN. Larger RCTs are required to determine the transanastomotic tube's further advantages and disadvantages.

Funding

The authors declare that they have not received funding.

Conflicts of interest

The authors declare no conflicts of interest.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that they have followed the protocols of their work center on the publication of patient data.

Right to privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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