












# Intraoperative and postoperative impact of pretransplantation transjugular intrahepatic portosystemic shunts in orthotopic liver transplantations: A systematic review and meta-analysis

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## ABSTRACT

**Objective:** Orthotopic liver transplantation (OLT) remains the definitive treatment for patients afflicted with end-stage liver disease (ESLD). Transjugular intrahepatic portosystemic shunts (TIPS) have been adapted as a bridge to transplantation, allowing partial normalization of portal pressure and associated symptom improvement. Conflicting evidence exists on TIPS' impact on operative procedures. This study aimed to analyze available evidence on patients who underwent OLT with prior TIPS compared to OLT alone with the intent to determine TIPS' impact on surgical outcomes.

**Material and Methods:** Following PRISMA guidelines, a systematic review was conducted, identifying studies comparing TIPS + OLT versus OLT alone in patients with ESLD. Data were analyzed using Review Manager 5.3.

**Results:** Thirteen studies were included. Operative time, packed red blood cells transfusions, intensive care unit admission, length of stay, dialysis, serum creatinine levels, ascites, vascular complications, bleeding revisions, reintervention, and other complications rates were similar between both groups. Fresh frozen plasma transfusion -2.88 units (-5.42, -0.35; p= 0.03), was lower in the TIPS + OLT group.

**Conclusion:** Our study found TIPS can be safely employed without having detrimental impacts on OLT outcomes, furthermore, these findings also suggest TIPS does not increase bleeding or complications.

**Keywords:** Liver transplant, transjugular intrahepatic portosystemic shunts, shunt, liver, model for end-stage liver disease

## INTRODUCTION

Liver transplantation (LT) is the definitive treatment for patients with end-stage liver disease (ESLD) and its related complications (1,2). Orthotopic liver transplantation (OLT) is limited by the disparity between limited available donors and recipients, as well as logistical and infrastructural challenges associated with organ donation (3,4). These difficulties result in long waiting times and risk further progression, and complications related to failing liver function (5,6). Efforts to offset this progression, as well as advances in medical and surgical therapy, have led to the optimization of medical management and refinement of procedures such as portosystemic shunt surgery. Minimally invasive transjugular intrahepatic portosystemic shunts have allowed the treatment of complications derived from portal hypertension such as variceal bleeding and ascites (7-9).

Transjugular intrahepatic portosystemic shunts (TIPS) have been adopted as a bridge to transplantation in patients with portal hypertension, allowing partial normalization of portal pressure and associated symptom improvement (10,11). TIPS; however, is a palliative and not a definitive treatment strategy (2).

Conflicting evidence exists on TIPS' impact on operative procedures. Some authors have described decreased operative bleeding secondary to reduced vascular engorgement and collateral circulation (12,13). In contrast, others postulate additional technical difficulties during the procedure such as reversal of the procedure adding complexity, especially while performing anastomosis (13).

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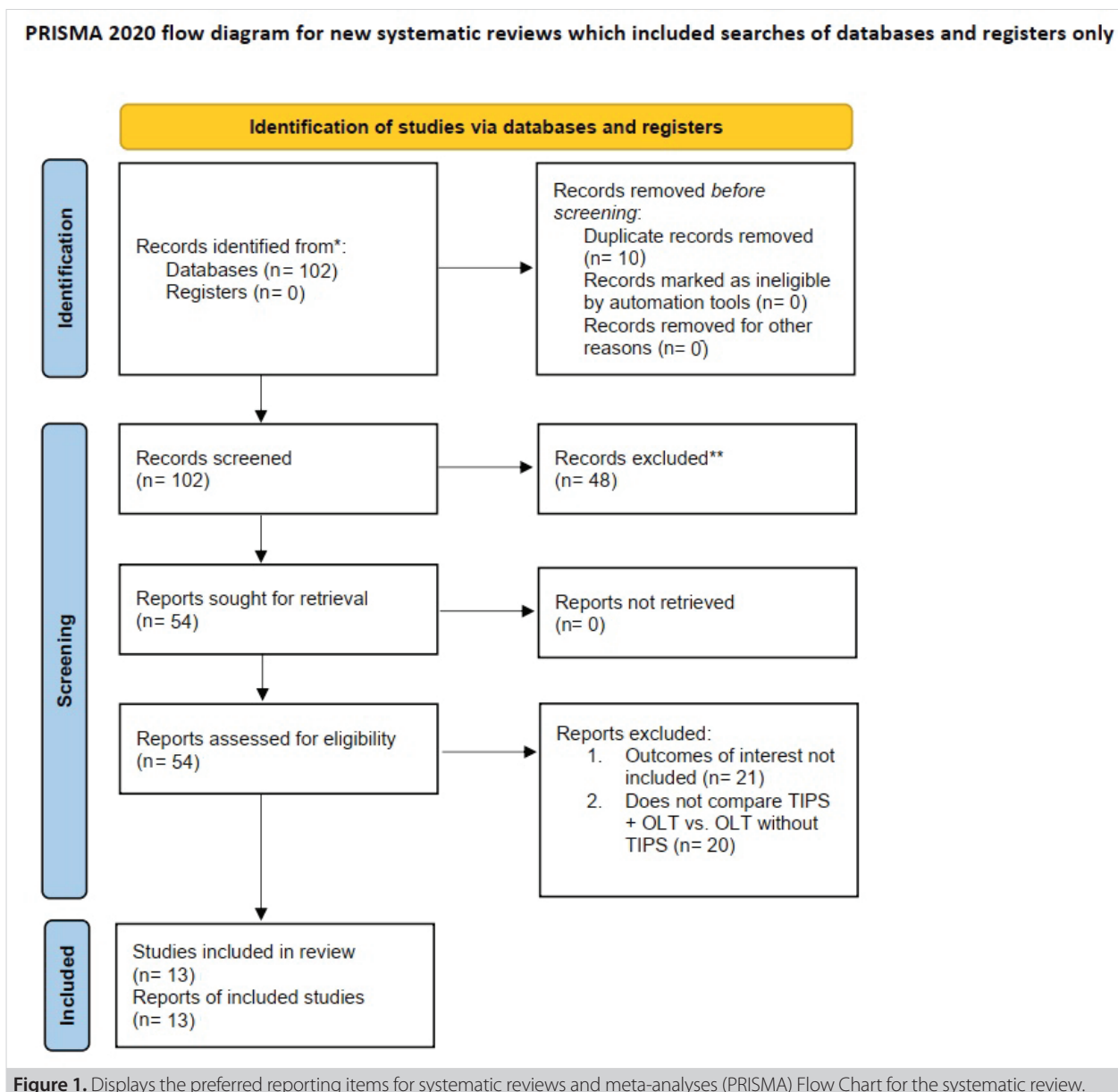
This review and meta-analysis aimed to analyze available evidence on operative and postoperative data on patients who underwent OLT with prior TIPS compared to OLT alone, with no previous clear-cut evidence on a large scale of TIPS' effect on OLT.

**MATERIAL and METHODS**

**Search Strategy and Screening**

Prior to starting the review, protocol registration was done in the National Institute for Health Research's PROSPERO tool. Our protocol is available with ID CRD42020204409 in the said website. Following the Preferred Instrument for Systematic Reviews and Meta-Analysis (PRISMA), a systematic database search was

performed in December 2020 with no limit on date search (Figure 1) (14). Studies comparing OLT with and without previous TIPS were identified through the search engines/databases of PubMed, Web of Science, and Google Scholar. The search was performed for studies that included in their title or abstract the following search string: "Transjugular Intrahepatic Portosystemic Shunt", "TIPS", "Orthotopic Liver Transplantation", "Transjugular Intrahepatic Portosystemic Shunt", "TIPS", "Orthotopic Liver Transplantation", and "Surgical Outcomes". Additionally, "similar articles" feature was employed to further screen possible manuscripts. No restrictions were applied to manuscript age and only manuscripts in either English or Spanish language were included. The identified manuscripts were further inde-



pendently screened by two authors/reviewers (MAEC, SUVDL) for possible inclusion, evidence grading, and data extraction. Any discrepancy between identified data was mediated by a third reviewer (GSG). Additional articles identified through related articles were also screened.

### Study Inclusion

Included studies statistically compared relevant outcomes of patients grouped into either TIPS + OLT or OLT alone in humans. Reporting data on operative time, intraoperative bleeding, time to a normal diet, length of hospital stay, and complications (including cholangitis, anastomosis leak, obstruction, reflux, and intervention) were included. General demographic data including patient age was also taken into consideration. No restrictions were applied for study type or patient age. Only case reports and case series of fewer than eight patients were excluded.

### Data Extraction

As previously mentioned, manuscripts were assessed independently by two reviewers for inclusion and data extraction. Data relevant to this meta-analysis besides authorship and year of publication were as follows, for preoperative parameters, age, Model for End-Stage Liver Disease (MELD), and Child-Pugh scores were considered. Within operative variables, operative time, number of transfused packed red blood cells, and units of fresh frozen plasma were included. For postoperative values, variables such as ICU admission and length of hospital stay, the need for dialysis, serum creatinine levels, presence of ascites, vascular complications, bleeding revisions, and reinterventions were included. Studies providing data in median and ranges were used to estimate mean and standard deviation using Wan's method (15). Studies that included means but not standard deviation, but with enough data (p-value and group sizes) were used to estimate standard deviation using the t-value per Cochran's Handbook recommendations (16). In order to avoid by-gone era bias, subgroups of the patient cohort dating prior to and after 2010 were introduced.

### Statistical Analysis

The collected data were analyzed using Review Manager v5.4.1 (Cochrane). Heterogeneity was measured using  $I^2$ , with studies obtaining values over 50% being considered heterogeneous and analyzed through random effects models, while studies with values under 50% were considered homogeneous and were analyzed through fixed-effects models. Continuous data including patient age, operative time, estimated blood loss, time to normal feeding, and length of stay was estimated using mean difference with 95% confidence intervals (CI). Dichotomous data such as complications were reported using Odds Ratios (OR) with 95% CI. The resulting values with associated p-values <0.05 were considered significant.

## RESULTS

A total of 103 studies were reviewed, of which 13 studies fulfilled the inclusion criteria for the meta-analysis. These 13 studies included 35492 patients, out of which 1885 underwent TIPS + OLT and 33607 underwent OLT alone. The summary of the analysis is displayed in Tables 1-2. Sub-group analysis featuring segregation by publication year cutoff was performed for each variable.

### Preoperative

#### Age

A total of 10 studies described patient age, totaling 1779 patients in the TIPS + OLT group and 33243 in the OLT alone group. Meta-analysis of this data revealed a mean difference of 1.87 (95% CI 0.03, 3.71)  $p=0.05$ . These findings suggest that under our population, patients who underwent OLT without TIPS were older than the OLT + TIPS group. This is further portrayed in Figure 2.A.

#### Model for End-Stage Liver Disease (MELD)

Five of the included studies described MELD score, totaling 1639 patients in the TIPS + OLT group and 32340 in the OLT alone group. Our analysis showed a mean difference of 0.48 (95%-1.35, 2.31)  $p=0.61$ , suggesting no statistically significant difference between preoperative MELD scores between the two groups. These findings are displayed in Figure 2.B.

#### Child-Pugh Score

Three studies reported preoperative Child-Pugh scores, with a total of 117 patients in the TIPS + OLT group and 201 in the OLT alone group. Mean Child-Pugh score was higher in the OLT alone population versus the OLT + TIPS group. Mean 0.41 (95% CI 0.01, 0.81)  $p=0.04$ . These findings are displayed in Figure 2.C.

### Operative

#### Operative Time

Ten studies described operative time, totaling 435 patients in the TIPS + OLT group and 1563 in the OLT only group. Meta-analysis of this data showed similar operating times in both groups, with a mean difference of 1.09 (95% CI-8.77, 10.94)  $p=0.83$ . These findings can be seen in Figure 3.A.

#### Packed Red Blood Cells

We identified 12 studies that reported the number of packed red blood cells (PRBC) transfused intraoperatively, totaling 519 patients in the TIPS + OLT group and 2190 in the OLT alone group. Meta-analysis of this data revealed a mean difference of 0.36 (95% CI-1.61, 2.32)  $p=0.93$ . These findings suggest no greater number of PRBC used during surgery in patients with TIPS undergoing OLT. These findings are displayed in Figure 3.B.

Table 1. Summary of key findings from included studies

Author Year	Study Type	Evi- dence Level	Patients (n)		Mean Age	MELD	Child-Pugh	Operative Time	PRBC	FFP	ICU	LoS	Dialysis	Creatinine	Ascites	Vascular Complica- tions		Bleeding Revisions	Reinter- vention	Other Complica- tions
			TIPS + OLT	TIPS Alone												TIPS + OLT	TIPS + OLT			
Antonini <sup>30</sup>	Retrospective	3	53	27	48	42	N.D.	188	212	2.6	2.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
John <sup>21</sup>	Retrospective	3	24	12	53.2	50.5	N.D.	497	480	13.2	14	8.7	11.7	N.D.	N.D.	N.D.	1	0	N.D.	N.D.
Lerut <sup>19</sup>	Retrospective	3	59	23	51.5	46.5	N.D.	N.D.	N.D.	21.9	8.84	N.D.	N.D.	N.D.	N.D.	N.D.	10	0	N.D.	N.D.
Chui <sup>31</sup>	Retrospective	3	186	8	178	N.D.	N.D.	486	490	20.6	41.5	15.6	57.1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Tripathi <sup>24</sup>	Retrospective	3	82	29	53	52	N.D.	414	379	15	10	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	0	2
Moreno <sup>32</sup>	Retrospective	3	76	26	50	N.D.	N.D.	538	518	7.3	4.7	15.6	17.3	N.D.	N.D.	N.D.	1	3	N.D.	0
Saad <sup>20</sup>	Retrospective	3	28	16	12	54	45.5	588	645	21.6	14.5	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
Guerrini <sup>35</sup>	Prospective	3	652	61	591	46	50	N.D.	N.D.	6.7	7.6	5.9	6.2	N.D.	N.D.	N.D.	4	40	N.D.	5
Vallivi- eso <sup>34</sup>	Retrospective	3	825	49	776	53.7	49	344	322	23.7	17	27	28.2	N.D.	N.D.	N.D.	2	6	N.D.	N.D.
Barbier <sup>12</sup>	Retrospective	3	208	72	136	N.D.	N.D.	346	360	4.5	5.2	10.2	12	N.D.	N.D.	N.D.	2	5	N.D.	N.D.
Mum- taz <sup>27</sup>	Retrospective	3	32,783	1,366	53.5	53.6	23.2	N.D.	N.D.	N.D.	N.D.	17.5	16.6	N.D.	N.D.	N.D.	N.D.	N.D.	15	560
Unger <sup>26</sup>	Retrospective	3	126	66	60	51.2	51.2	348	337	3.3	5	6.6	6.6	N.D.	N.D.	N.D.	4	3	4	6
Mat- sushi- ma <sup>35</sup>	Retrospective	3	390	130	260	57.5	57.1	425	420	8.8	8.2	7.4	7.6	N.D.	N.D.	N.D.	7	20	N.D.	2

TIPS: Transjugular intrahepatic portosystemic shunt; OLT: Orthotopic liver transplantation; N.D.: No Data; MELD: Model for end-stage liver disease; PRBC: Packed red blood cells; FFP: Fresh frozen plasma; ICU: Intensive care unit; LoS: Length of stay.

**Table 2.** Summary of the findings from our meta-analysis in key variables

Outcomes	Studies	TIPS + OLT	OLT Alone	WMD/OR (95%CI)	p	Heterogeneity			
						$\chi^2$	df	I <sup>2</sup> %	p
<i>Preoperative</i>									
Age	10	1.779	33.243	1.87 [0.03, 3.71]	p= 0.05	50.39	9	82	p< 0.00001
MELD	5	1.639	32.340	0.48 [-1.35, 2.31]	p= 0.61	48.94	4	92	p< 0.00001
Child-Pugh Score	3	117	201	0.41 [0.01, 0.81]	p= 0.04	1.36	2	0	p= 0.04
<i>Operative</i>									
Time	10	435	1.563	1.09 [-8.77, 10.94]	p= 0.83	15.88	9	43	p= 0.07
PRBC	12	519	2.190	0.36 [-1.61, 2.32]	p= 0.72	143.75	11	92	p< 0.00001
FFP	8	424	2.063	-2.88 [-5.42, -0.35]	p= 0.03	64.96	7	89	p< 0.00001
<i>Postoperative</i>									
ICU	5	181	1.482	-1.86 [-7.85, 4.13]	p= 0.54	186.81	4	98	p< 0.00001
LoS	7	1.695	32.728	0.78 [-3.93, 5.50]	p= 0.74	103.21	6	94	p< 0.00001
Dialysis	2	138	196	0.00 [-0.08, 0.07]	p= 0.93	2.51	1	60	p= 0.11
Creatinine	5	1.695	32.464	-0.02 [-0.16, 0.12]	p= 0.79	75.41	4	95	p< 0.00001
Ascites	2	138	196	11.41 [0.23, 567.75]	p= 0.22	6.29	1	84	p= 0.01
Vascular complications	8	439	1.921	1.38 [0.87, 2.19]	p= 0.17	13.14	7	47	p= 0.07
Bleeding revisions	1	66	60	0.58 [0.16, 2.17]	p= 0.42	N.A.	N.A.	N.A.	N.A.
Reintervention	5	1.612	32.371	0.65 [0.42, 1.00]	p= 0.05	0.87	4	0	p= 0.93
Other complications	1	3	7	0.80 [0.19, 3.40]	p= 0.76	N.A.	N.A.	N.A.	N.A.

DTIPS: Transjugular intrahepatic portosystemic shunt, OLT: Orthotopic liver transplantation, N.A.: Not applicable, ICU: Intensive care unit, LoS: Length of stay.

### Fresh Frozen Plasma

We identified eight studies that provided a number of transfused Fresh Frozen Plasma (FFP) units, totaling 424 patients in the TIPS + OLT group and 2063 in the OLT alone group. We found a mean difference of -2.88 (95% CI -5.42, -0.35)  $p= 0.06$ , suggesting that the OLT alone group received more FFP units than the TIPS + OLT group. These findings are displayed in Figure 3.C.

### Postoperative

#### Intensive Care Unit

A total of five studies described rates of admission to intensive care unit (ICU) following surgery, totaling 181 patients in the TIPS + OLT group and 1482 in the OLT alone group. There was no difference between the need of ICU in both groups, with a mean of -1.86 (95% CI -7.85, 4.13)  $p= 0.54$ . These findings are displayed in Figure 3.D.

#### Length of Stay

Seven studies described the length of hospital stay after surgery. This resulted in a total of 1695 patients in the TIPS + OLT group and 32728 patients in the OLT alone group. Further analysis of hospital stay showed a mean difference of 0.78 (95% CI -3.93, 5.50)  $p= 0.74$ , suggesting no greater length of stay in either group. These findings are displayed in Figure 4.A.

### Dialysis

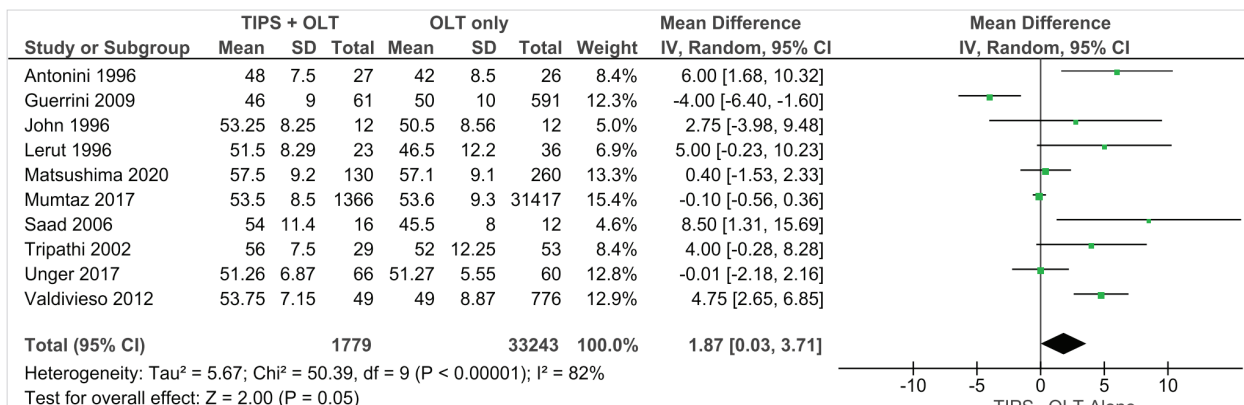
Only two studies described the use of dialysis, with 138 patients in the TIPS + OLT group and 196 in the OLT alone group. Meta-analysis of this data revealed a risk difference of 0.00 (95% CI -0.08, 0.07)  $p= 0.93$ . These findings suggest that both groups have a similar risk of undergoing dialysis after OLT. Our findings can be seen in Figure 4.B.

### Creatinine

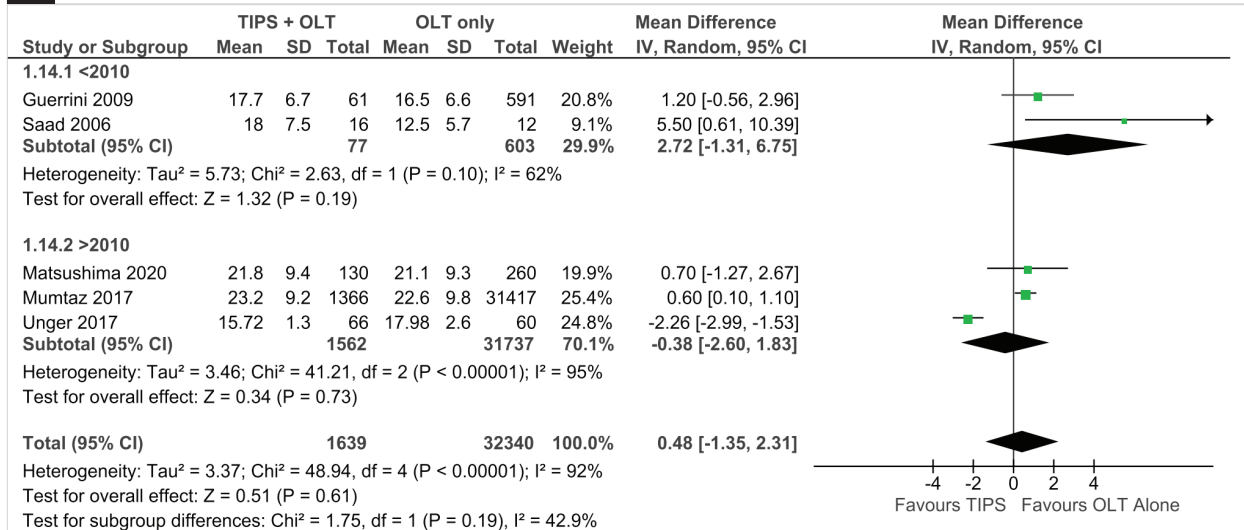
Five studies reported serum creatinine levels after surgery, resulting in 1695 patients in the TIPS + OLT group and 32464 in the OLT only group. Analysis of this data revealed a mean difference of -0.02 (95% CI -0.16, 0.12)  $p= 0.79$ , suggesting no difference between serum creatinine between the two groups. Full data is displayed in Figure 4.C.

### Ascites

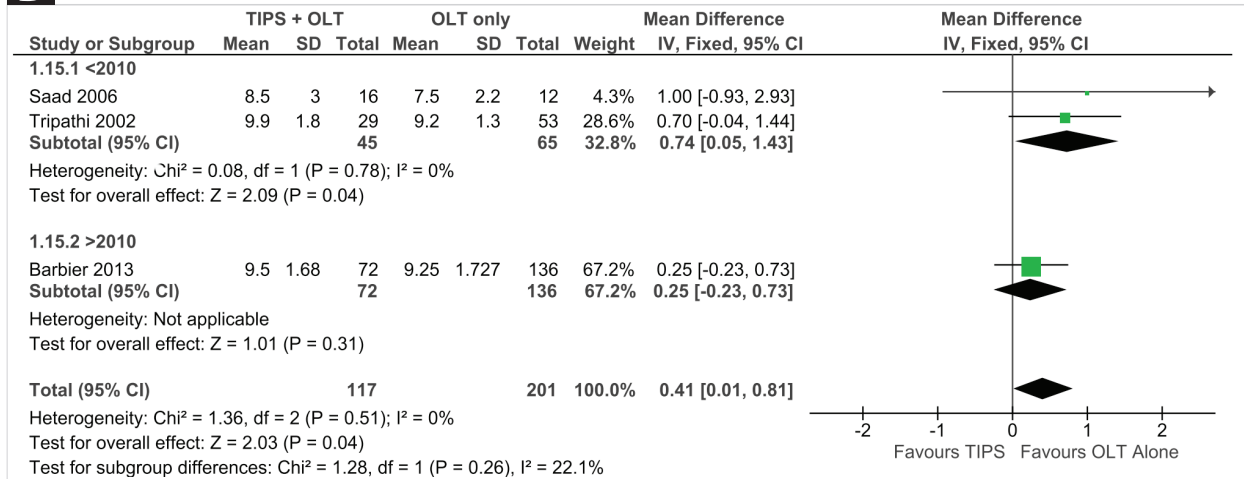
Data associated with patients developing ascites postoperatively was limited to two studies. This resulted in 138 patients in the TIPS + OLT group and 196 in the OLT only group. Comparison shows an odds ratio of 11.41 (95% CI 0.23, 567.75)  $p= 0.22$ . This finding suggests that both groups have a similar risk of developing ascites, as demonstrated in Figure 4.D.



**A**



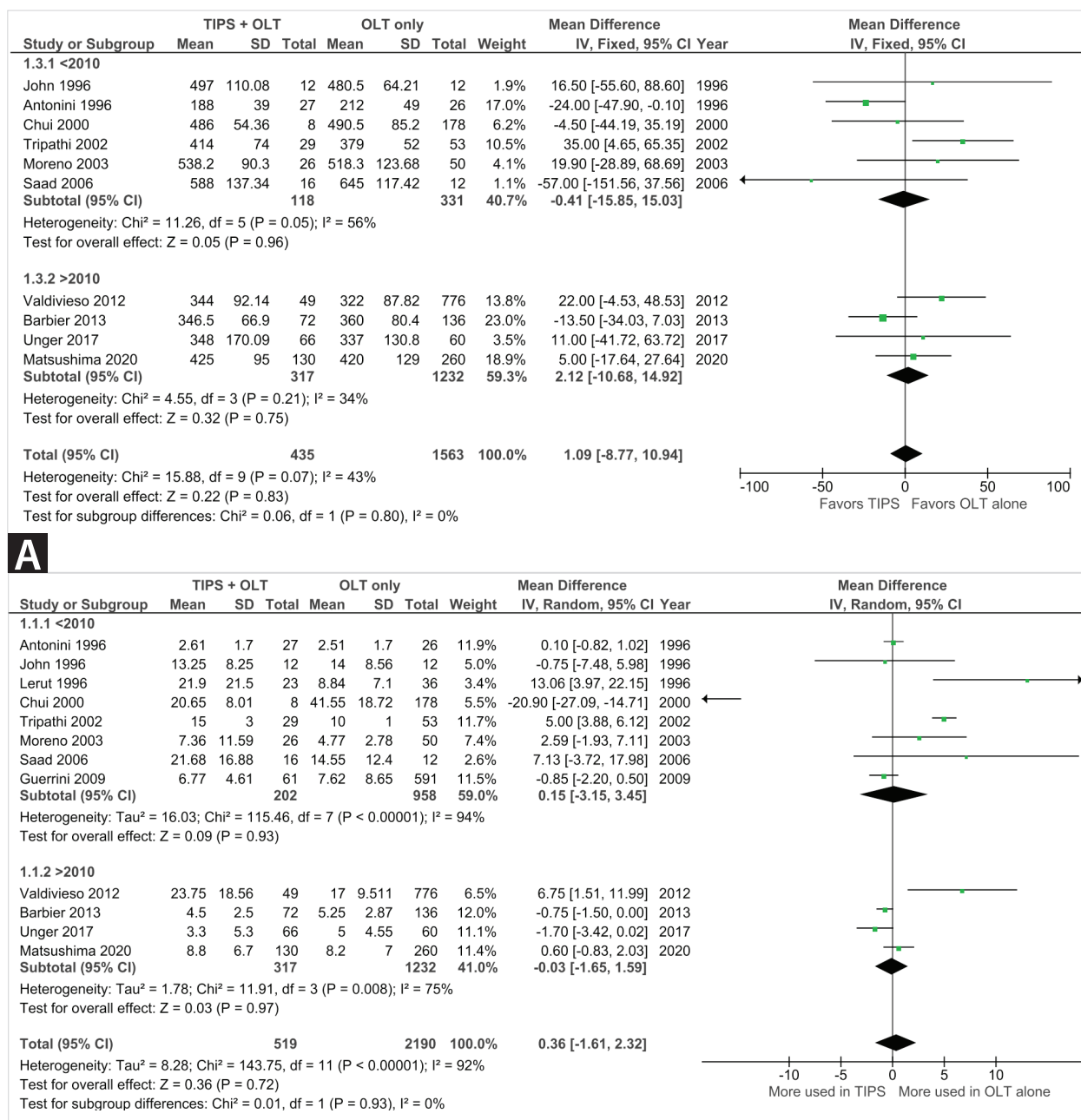
**B**



**C**

**Figure 2.** Displays forest plots of meta-analysis of the following variables: **A.** Age, **B.** Model for end-stage liver disease (MELD), and **C.** Child-pugh score.





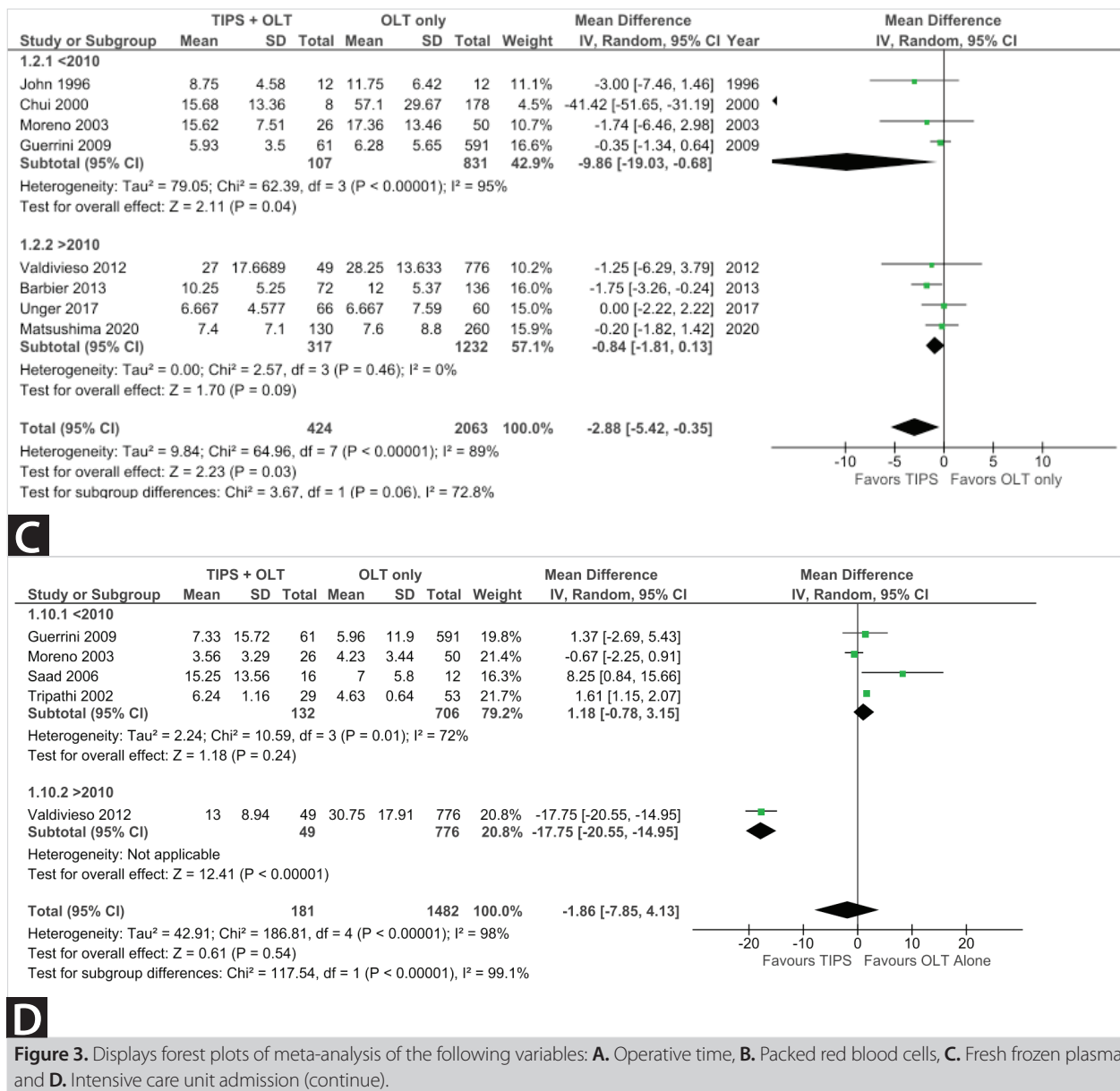
**Figure 3.** Displays forest plots of meta-analysis of the following variables: **A.** Operative time, **B.** Packed red blood cells, **C.** Fresh frozen plasma and **D.** Intensive care unit admission.

**Vascular Complications**

Within our included studies, eight described vascular complications within their population. This yields a total of 439 patients in the TIPS + OLT group and 1921 in the OLT alone group. Most notable vascular complications included portal or hepatic vein thrombosis. Analysis of this data revealed an odds ratio of 1.38 (95% CI 0.87, 2.19) p= 0.17. These findings suggest that having undergone prior TIPS does not increase the risk for vascular complications following OLT. Our findings are shown in Figure 5.A.

**Reintervention**

No significant difference was found between reintervention in TIPS + OLT versus OLT alone. Five studies were included in the analysis, with 1612 patients in the TIPS + OLT group and 32371 in the OLT alone group. Analysis revealed an odds ratio of 0.66 (95% CI 0.43, 1.01) p= 0.06. The forest plot of the association of events is represented in Figure 5.B



**Figure 3.** Displays forest plots of meta-analysis of the following variables: **A.** Operative time, **B.** Packed red blood cells, **C.** Fresh frozen plasma and **D.** Intensive care unit admission (continue).

**DISCUSSION**

Transjugular intrahepatic portosystemic shunt (TIPS) has established its role as a bridge therapy to live transplantation ameliorating the remarkable mismatch between the donors and recipients (4,10,11). TIPS' original therapeutic indication for refractory variceal bleeding has expanded other complications related to portal hypertension (17,18). Despite its benefits on palliation of portal hypertension, controversy remains over TIPS' impact on liver transplantation.

Previous authors have described the use of TIPS as a method of reduction of operative bleeding secondary to portal pressure normalization (19-21). A reduction in transfusion requirements

and operative time is not described in the current literature. This is in contrast to the notions of other authors who note that TIPS adds technical difficulties during liver transplant (22-24). Other studies demonstrate that TIPS implementation before transplantation does not carry added risk nor advantages during LT (12,13,25,26). TIPS are intrahepatic and under optimal situations are removed with the native liver when performing OLT, not requiring any additional steps during surgery. We found that both groups had a similar length of stay, which contrasts with other meta-analyses that report longer length of stay in TIPS group (27). Notwithstanding, it seems like TIPS performs better than surgical shunts, which are associated with more bleeding (25).



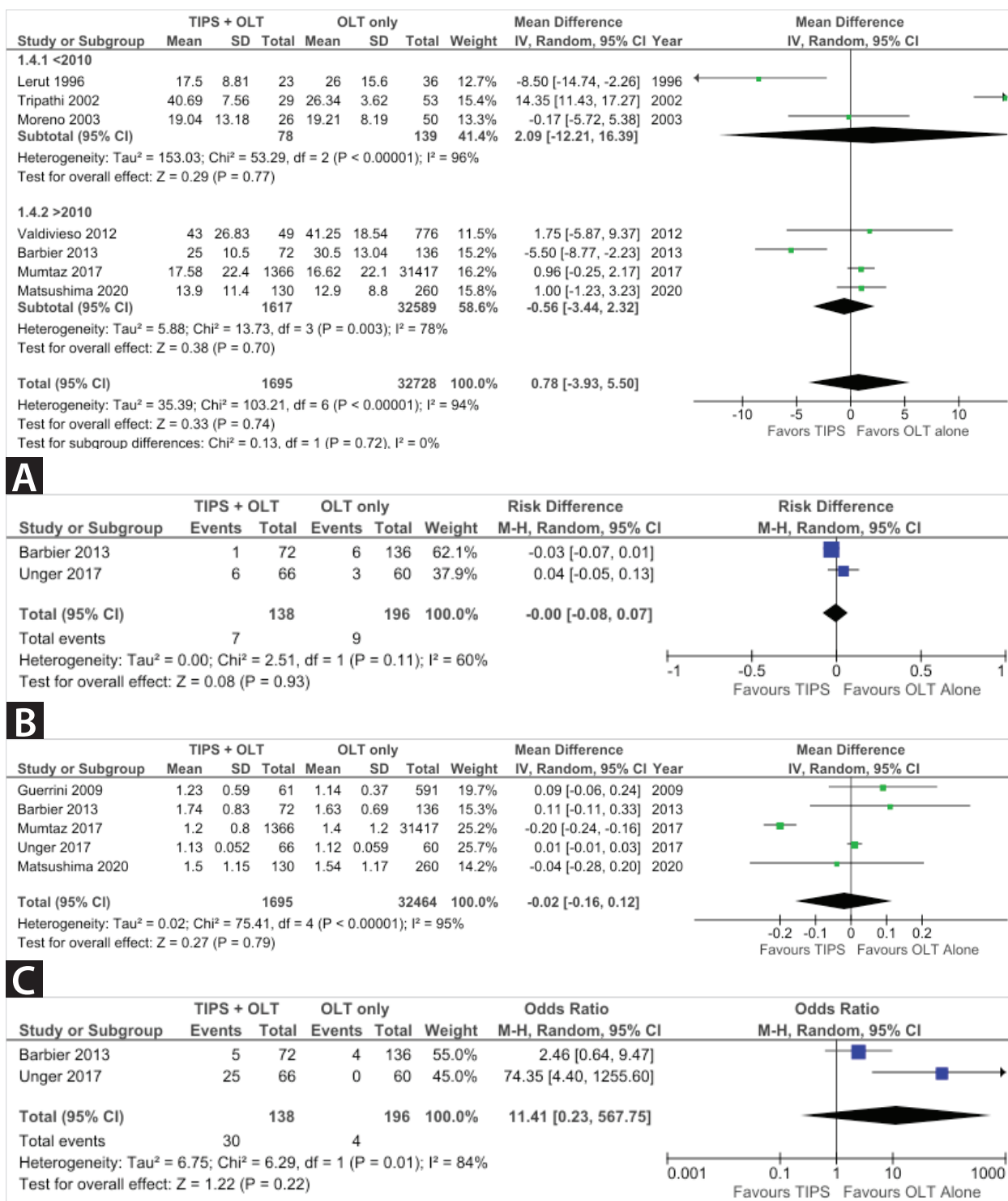


Figure 4. Displays forest plots of meta-analysis of the following variables: A. Length of stay, B. Dialysis, C. Serum creatinine levels, and D. Ascites.

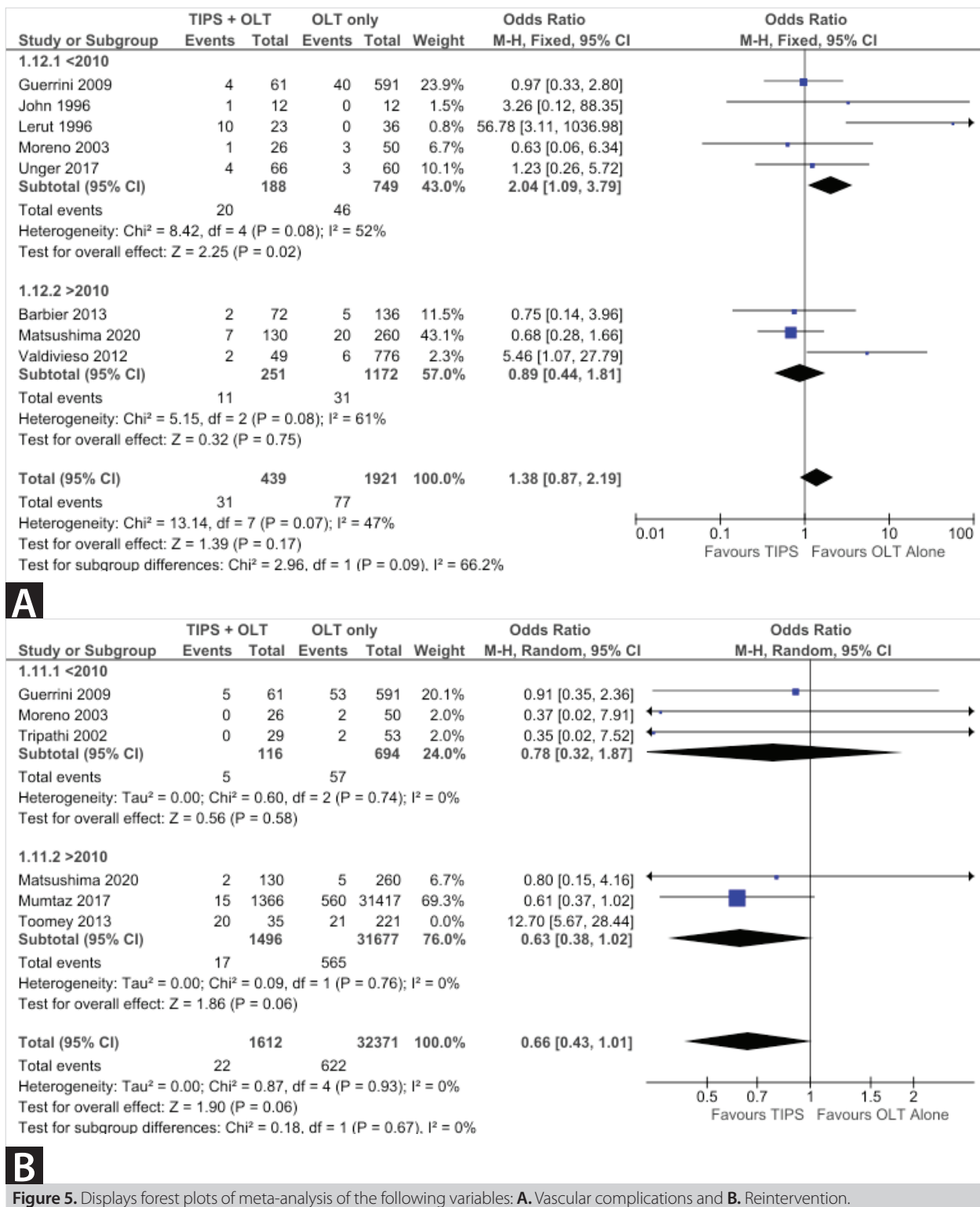


Figure 5. Displays forest plots of meta-analysis of the following variables: **A.** Vascular complications and **B.** Reintervention.

Findings from our own analysis suggest TIPS has no impact on operative and postoperative outcomes during OLT. Baseline characteristics from included studies showed suggested similar patient cohorts. Operative time and bleeding were non-differ-

ent between the groups, which suggests TIPS presence does not significantly prolong procedures, and its amelioration of portal hypertension does not reduce bleeding. Of note, only fresh frozen plasma use was significantly higher in non-TIPS OLT.

This is driven by a single study by Chui et al. published in 2000 which additionally introduces significant heterogeneity. Sensitivity analysis with exclusion of this study reveals 0% heterogeneity and no significant differences. Similarly, similar length of stays, ICU stays and reinterventions were found.

Concerns on TIPS's impact on waiting list time have been previously raised. TIPS implementation may prolong waiting list time for LT while having comparable post-procedural mortality as non-TIPS counterparts. This increase in waiting list time is a consequence of an improvement in parameters such as MELD score. Non-TIPS patients are thus pushed upwards in the transplant list, causing this group to undergo LT first (27).

TIPS bridging potential must be weighed against possible procedural and postoperative complications (28). These may include migration, occlusion, and worsening of hepatic encephalopathy. Because of this, frequent surveillance is warranted and reinterventions become a possibility (28, 29). The summary of these key findings may be seen in the Table 1 (12,19,20,21,24,26,27,30-35).

From a hospital administration, finances, and resources perspective, there is evidence that there is no significant difference in usage of hospital resources between OLT + TIPS and OLT alone groups; an increased use of resources is described in surgical portosystemic shunts (20).

This study aimed to determine if TIPS has a negative or positive impact on LT and the immediate postoperative period. The study is limited by the lack of robust, high-quality studies on the topic, data estimation and inter study heterogeneity. Additionally, there may be inherent differences in patients who underwent TIPS from those who did not, as the TIPS group may have preserved synthetic function and may be the reason for differences in FFP usage. The wide time frame of included studies may result in by-gone era bias. Lastly, the largest included study is from a UNOS database and as such may bias results; however, sensitivity analysis with the exclusion of this study did not significantly alter results.

## CONCLUSION

Analysis of available evidence shows TIPS has no negative or positive impacts on operating time, operative bleeding, ICU admission or complications when compared to patients undergoing OLT without prior TIPS. This suggests TIPS can be safely employed without having detrimental impacts on surgical outcomes if patients undergo OLT, furthermore, these findings also suggest TIPS bleeding or complications are not different from OLT only.

**Ethics Committee Approval:** Not relevant.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - E.F.V., F.E.H.C., D.E.H.G., G.S.G.; Design - D.E.H.G., G.S.G.; Supervision - E.F.V., A.E.C., S.U.V.D.L.; Data Collection and/or Processing - G.S.G., F.E.H.C., S.U.V.D.L., A.R.M., L.C.B.G., A.E.C., E.T.G.; Analysis and/or Interpretation - E.T.G., A.E.C., L.C.B.G., D.E.H.G.; Literature Search - F.E.H.C., S.U.V.D.L., A.R.M.; Writing Manuscript - E.T.G., G.S.G.; Critical Reviews - D.E.H.G., L.C.B.G.

**Conflict of Interest:** The authors have no conflicts of interest to declare.

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## ORJİNAL ÇALIŞMA-ÖZET

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### Ortotopik karaciğer transplantasyonunda transplantasyon öncesi transjuguler intrahepatik portosistemik şantın intraoperatif ve postoperatif etkileri: Sistematik bir derleme ve meta analiz

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#### ÖZET

**Giriş ve Amaç:** Ortotopik karaciğer transplantasyonu (OKT) son evre karaciğer hastalığında (SEKH) kesin tedavi yöntemidir. Transjuguler intrahepatik portosistemik şantlar (TIPS), transplantasyona bir köprü olarak uyarlanmıştır ve portal basıncın parsiyel normalleşmesine ve ilişkili semptomların iyileşmesine sebep olur. Operatif prosedürlerde TIPS'in etkisi ile ilgili çelişkili kanıtlar vardır. Bu çalışmanın amacı, TIPS'in cerrahi sonuçlara etkisini belirlemek adına önce TIPS sonra OKT geçiren ve sadece OKT geçiren hastaların verileri analiz etmektir.

**Gereç ve Yöntem:** SEKH sahip hastalarda TIPS + OKT ve sadece OKT uygulanan hastaların bulunduğu çalışmalar belirlenip PRISMA kılavuz ilkelelerini takip ederek bir sistematik değerlendirme uygulandı. Veriler Data Review Manager 5,3 kullanılarak analiz edildi.

**Bulgular:** On üç çalışma dahil edildi. Her iki grupta da operatif süre, alyuvar transfüzyonu, yoğun bakımda kalış süresi, hastanede kalış süresi, diyaliz, serum kreatinin seviyeleri, assit, vasküler komplikasyonlar, kanama revizyonları, tekrar müdahale ve diğer komplikasyonlar benzerdi. Taze donmuş plazma transfüzyonu -2,88 ünite (-5,42, -0,35; p= 0,03) TIPS + OKT grubunda daha düşüktü.

**Sonuç:** Çalışmamızda, TIPS'nin OKT sonuçlarına zararlı herhangi bir etkisi olmadan güvenle uygulanabileceğini ve bundan ötürü de TIPS'nin kanamayı veya komplikasyonları artırmadığını bulduk.

**Anahtar Kelimeler:** Karaciğer transplantasyonu, transjuguler intrahepatik portosistemik şantlar, şant, karaciğer, son evre karaciğer hastalığı

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