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The Effect of Postoperative Nutrition Initiation Time on the Development of Complications and Duration of Hospital Stay in Patients with Liver Transplantation: Retrospective Study

Karaciğer Transplantasyonlu Hastalarda Postoperatif Beslenmeye Başlama Zamanının Komplikasyon Gelişimi ve Hastanede Kalış Süresi Üzerine Etkisi: Retrospektif Araştırma

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ABSTRACT Objective: In the last period of liver failure, the issue of nutrition gains importance due to disturbances in carbohydrate, fat and lipid metabolism and the catabolic state that occurs during the transplantation process. Current guidelines recommend feeding 12-24 hours after liver transplantation unless a complication that affects nutritional status has developed. However, there are limited studies in the literature showing the effects of the transition to nutrition after liver transplantation on patients. The aim of this study is to determine the effect of transition to postoperative nutrition on complication development and hospital stay in liver transplant patients. **Material and Methods:** The universe of the study consisted of 77 patients who had surgery between 2017-2022. Four patients were excluded from the study due to in-hospital mortality and two patients due to dysfunction. 69 patients who had liver transplantation were included in the study. The 18-question data form prepared by the researchers was filled in retrospectively. **Results:** As a result of the study, gas output was detected on the first day in 92.5% of the patients fed at the postoperative 24th hour and in 93.5% of the patients fed at the 48th hour. Complications were seen in 80% of the patients fed at 96th hour. The hospital stay was found to be higher in patients fed at the 96th hour compared to the other groups ($p<0.05$). When compared with the postoperative nutrition time, a significant difference was found between feeding hours and the incidence of complications, postoperative hospital stay, gas removal time and the type of complication ($p<0.05$). **Conclusion:** As a result of this research, it was determined that early postoperative nutrition in patients who underwent liver transplantation shortened the duration of hospital stay, provided early gas release and reduced the incidence of complications.

Keywords: Liver transplantation; hospital stay; postoperative complications; postoperative nutrition

ÖZET Amaç: Karaciğer yetersizliğinin son döneminde karbonhidrat, yağ ve lipid metabolizmasındaki bozukluklar ve nakil sürecinde oluşan katabolik durum nedeniyle beslenme konusu önem kazanmaktadır. Mevcut kılavuzlar, beslenme durumunu etkileyecek bir komplikasyon gelişmediyse karaciğer naklinden 12-24 saat sonra beslenmeyi önermektedir. Ancak literatürde karaciğer nakli sonrası beslenmeye geçişin hastalar üzerindeki etkilerini gösteren sınırlı sayıda çalışma bulunmaktadır. Bu çalışmanın amacı, karaciğer nakli yapılan hastalarda postoperatif beslenmeye geçişin komplikasyon gelişimi ve hastanede kalış süresine etkisini belirlemektir. **Gereç ve Yöntemler:** Araştırmanın evrenini 2017-2022 yılları arasında ameliyat olan 77 hasta oluşturdu. Dört hasta hastane içi mortalite, iki hasta ise disfonksiyon nedeniyle çalışmadan çıkarıldı. Çalışmaya karaciğer nakli yapılan 69 hasta dâhil edildi. Araştırmacılar tarafından hazırlanan 18 soruluk veri formu geriye dönük olarak doldurduldu. **Bulgular:** Araştırma sonucunda postoperatif 24. saatte beslenen hastaların %92,5'inde, 48. saatte beslenen hastaların %93,5'inde ilk gün gaz çıkışı tespit edildi. 96. saatte beslenen hastaların %80'inde komplikasyon görüldü. 96. saatte beslenen hastaların hastanede kalış süresi diğer gruplara göre daha yüksek bulundu ($p<0,05$). Ameliyat sonrası beslenme süresi ile karşılaştırıldığında beslenme saatleri ile komplikasyon görülme sıklığı, ameliyat sonrası hastanede kalış süresi, gaz çıkarma süresi ve komplikasyon türü arasında anlamlı fark bulundu ($p<0,05$). **Sonuç:** Bu araştırma sonucunda, karaciğer transplantasyonu yapılan hastalarda postoperatif erken beslenmenin hastanede kalış süresini kısalttığı, erken gaz çıkışı sağladığı ve komplikasyon görülme sıklığını azalttığı belirlendi.

Anahtar Kelimeler: Karaciğer nakli; hastanede kalış; ameliyat sonrası komplikasyonlar; postoperatif beslenme

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Liver transplantation is the replacement of the recipient's liver tissue with a portion of the normal-functioning liver tissue removed from a brain-dead or healthy person.[1] Liver transplantation is one of the most effective treatment methods for end-stage liver failure. This method has become a treatment option especially in patients with end-stage liver disease and hepatocellular carcinoma.[2] It is a successful treatment option; one-year survival rate of patients after transplantation is 96%, three-year survival rate is 85% and five-year survival rate is 70%.[1] In recent years, innovations in surgical techniques used in organ transplantation and immunosuppressive, antiviral and antimicrobial treatment processes have enabled more people to benefit from liver transplantation.[3-5] In the United States, which has the largest patient series in organ transplantation, around 7,000 liver transplants were performed in 2017, almost all of them from cadavers.[6] In Türkiye, a total of 1,588 liver transplants were performed in 2018, 1,150 from living donors and 438 from cadavers.[7] In this respect, liver transplantation is an important surgical procedure considering the number of applications.

Since liver transplantation is performed for patients with end-stage liver failure, protein-energy malnutrition and impairments in carbohydrate, protein and lipid metabolism are observed in most of these patients.[8] In addition, transplantation is a stress factor for patients and the body increases the basal metabolic rate against stress, utilizes nitrogen stores and creates a negative nitrogen balance. Acute phase proteins are synthesized and gluconeogenesis increases.[9] In the surgical procedure, intestinal permeability increases and villus height decreases, which leads to malabsorption.[10] Nutrition aimed at rectifying these catabolic conditions that occur before and after surgery becomes important in liver transplantation.

It is recommended to initiate nutrition 12-24 hours after an uncomplicated liver transplantation.[11] This issue is addressed in several guidelines.[12-14] The most recent of these guidelines is the "Guidelines for Perioperative Care for Liver Transplantation", published in 2021 as part of the Enhanced Recovery After Surgery (ERAS). ERAS is a term describing evidence-based perioperative practices with more than 20 elements.[15] In the Guidelines for Perioperative Care for Liver Transplantation, ERAS recommends initiating normal food oral intake and/or enteral nutrition (nasogastric tube or jejunostomy) 12-24 hours after liver transplantation, according to patient's tolerance, and considering parenteral nutrition as the very last option, when the use of oral route (enteral feeding tubes or jejunostomy) is not possible.[16] Feltracco et al. reported that initiating early nutrition and providing nutritional support in the postoperative period would reduce mortality, morbidity and length of hospital stay.[17] In their meta-analysis, Yirui et al. reported that early nutrition in patients with liver transplantation reduced postoperative infection rates, reduced intensive care unit and hospital stay, and improved liver function.[18] In another meta-analysis, Fuentes Padilla et al. investigated the relationship between the nutrition time and the incidence of complications in critically ill adults and reported that the results regarding early nutrition were unsatisfactory due to the low level of evidence of the studies in which nutrition was initiated within and after 48 hours.[19] In their randomized controlled trial, Kim et al. reported that initiating early feeding in patients with liver transplantation reduced the risk of bacterial infection and shortened the duration of hospital stay.[20]

The number of studies in the literature reporting the effects of initiating early nutrition after liver transplantation is limited.[20-22] Fuentes Padilla et al. pointed out that although early nutrition is recommended by guidelines, there is a lack of evidence related to complications or benefits.[19] The present study is expected to contribute to the literature by retrospectively reviewing the relationship between the time of initiating postoperative nutrition and the incidence of complications and length of hospital stay in patients with liver transplantation.

PURPOSE OF THE STUDY

The purpose of this retrospective and descriptive study was to reveal the effect of postoperative nutrition initiation time on the development of complications and length of hospital stay in patients with liver transplantation.

SAMPLE OF THE STUDY

77 patients who had undergone liver transplantation between 01 January 2017 and 01 January 2022 were

initially included in the present study. Six patients were excluded from the study due to in-hospital mortality within the first five days and two patients were excluded due to redo transplantation caused by primary dysfunction. The sample of the study consisted of 69 patients.

DATA COLLECTION TOOLS

An 18-question data collection form developed by the researchers in line with the literature including items related to age, gender, type of transplantation, The American Society of Anaesthesiologists (ASA) score, presence of chronic diseases, type of chronic disease, The Model for End-Stage Liver Disease (MELD) score, time of initiating postoperative nutrition, type of nutrition, complications observed in the patient, type of complication management, length of hospitalization, duration of flatulence, duration of surgery, duration of intubation, in-hospital mortality, total mortality, and death-survival status was used for data collection.[13,16,18,23,24] ASA score is a classification system to identify factors that predict a patient's surgery risks. ASA I is classified as a healthy individual, ASA II as an individual with mild systemic disease, ASA II as an individual with severe systemic disease, ASA IV as an individual with a life-threatening condition, ASA V as an individual with no chance of survival without surgery, and ASA VI as an individual with a brain-dead donor.[25] The MELD score is a scoring system to assess the severity of chronic liver disease. It is calculated with values such as jaundice tests, bleeding tests, kidney tests. A calculated MELD score of 10 or greater means that you are a candidate for liver transplantation.[26]

DATA COLLECTION AND

After ethics committee approval and permission of the institution were granted for the study, the data collection form was completed by the researcher based on the data obtained from the patient records in the hospital archive. The researchers who collected the data were the physicians who provided surgical and medical treatment to the patients and archived the data. The data were collected from both electronic and physical patient records in the hospital's archive for approximately two months. Filling out the data collection form for each patient file took approximately thirty minutes.

DATA ANALYSIS

SPSS IBM Statics 22 was used for data analysis. Shapiro-Wilk test was employed to evaluate the distribution of the data. In addition to the frequency and mean values, Mann-Whitney U, Kruskal-Wallis, Pearson's chi-square tests and Linear Regression were used to investigate the relationship between the variables. The statistical significance level was set at 0.05.

ETHICAL ASPECT

The Ankara Yıldırım Beyazıt University Ethics Committee approval and permission from the institution were obtained with the research code 2022-802 (date: April 5, 2020) assigned by the Scientific Research Platform of the Ministry of Health of the Republic of Türkiye to evaluate the ethical appropriateness of the study. Consent was obtained before the surgery so that patient data could be used for research purposes. In order to protect the personal information of the patients, the data from the patient file was filled in by the authors, who are the patient's physicians, and their personal data was also protected from other researchers. The study protocol was prepared in accordance with the principles of the Declaration of Helsinki.

RESULTS

The mean age of the patients in the sample was 47.7±12.5 years, the mean MELD score was 23.8±8.6 (min: 0, max: 43), and the mean duration of surgery was 474.8±49.3 minutes (min: 390, max: 580). All patients were fed orally in the postoperative period. The patients started postoperative oral nutrition within a mean of 44 hours (44.2±20.8; min: 24, max: 69 hours) and the mean duration of hospitalization was 40 days (40.2±85.9; min: 10, max: 510 days) (Table 1). 58% (n=49) of the patients were male, 65.2% (n=45) received a transplant from a living donor, 27.5% (n=19) had chronic diseases and 66.7% (n=46) were in the ASA II score group. Complications were observed in 26.1% (n=18) of the operated patients, with wound infection being the most common complication (8.7%; n=6). Of the patients with complications, 23.2% (n=16) received medical treatment and 1.4% (n=1) received temporary dialysis ses-

TABLE 1: The average of the data on the patients participating in the study' yerine 'The mean values for the data of the participants.

Patient data	n	Minimum	Maximum	X̄±SD
Age (year)	69	17	67	47.7±12.5
MELD points	69	0	43	23.8±8.6
Surgery time (minutes)	69	390	580	474.8±49.3
Time intubated (day)	69	0	2	0.23±0.6
Postoperative feeding time (hours)	69	24	96	44.2±20.8
Gas discharge (day)	69	1	3	1.3±0.6
Postoperative hospital stay	69	10	510	40.2±85.9

MELD: Model for End-Stage Liver Disease; SD: Standard deviation.

sions, and 1.4% (n=1) were followed up with an interventional percutaneous drainage catheter. The in-hospital mortality rate was 10.1% (n=7) and the total mortality rate was 21.7% (n=15) (Table 2).

No statistically significant difference was found when the complication rate and flatulence time were compared by gender ($p>0.05$). 92.5% of the patients stated nutrition at 24th hour and 93.5% of the patients started nutrition at 48th hour gas discharged on the first day. Complications were observed in 80% of the patients who started nutrition at 96th hour. All of the patients fed at the 72nd hour flatulence on the 2nd postoperative day, and all of the patients fed at the 96th hour flatulence on the 3rd postoperative day. The duration of hospital stay was higher in the patients who started nutrition at 96th hour compared to the other groups ($p=0.03$). No significant difference was found between the incidence of complications, duration of postoperative hospital stay, gas discharge and type of complication when compared by postoperative nutrition time ($p<0.05$) (Table 3, Table 4). Postoperative nutrition time had no significant correlation with in-hospital mortality and survival ($p=0.73$, $p=0.18$) (Table 3).

When gender and gas discharged time were compared, women were found to have shorter flatulence times than men and the difference was significant ($p=0.018$). When the duration of hospital stay was compared, it was found that the patients with chronic diseases had longer hospital stays ($p=0.09$; Table 6).

No significant difference was found between postoperative nutrition time, incidence of complications, length of hospital stay and flatulence time and duration of surgery, duration of intubation and MELD score ($p>0.05$; Table 7).

DISCUSSION

Current guidelines recommend early initiation of postoperative nutrition in patients.[13,16,27] The guidelines published by the European Society for Clinical Nutrition and Metabolism in 2021 recommend early oral food intake or enteral nutrition 24 hours after liver transplantation, and the ERAS guidelines recommend early oral food intake or enteral nutrition 12-24 hours after liver transplantation.[16-27] The purpose of recommending postoperative early nutrition by ERAS guidelines is explained as stimulation of early postoperative gastrointestinal motility.[16] Usui et al. reported in their study that early nutrition after liver transplantation improved bowel movement.[23] Similarly, positive effects of postoperative early nutrition transition on flatulence have been reported in different surgical procedures. Mahmoodzadeh et al. started gastrectomy patients on early liquid diet on the second postoperative day. As a result of the randomized controlled trial, the flatulence time was shortened at a statistically significant level in the group that started early nutrition.[28] Fanning and Hojat reported that early postoperative nutrition was safe and effective in preventing ileus in their study with 707 patients who had undergone gynecologic surgery.[29] Similarly, Zhou et al. studied patients who had undergone colorectostomy and reported that early oral food intake was safe and accelerated the restoration of bowel function.[30] In the present study, we found that the patients who started nutrition within 24-48 hours post-

TABLE 2: Frequency of patient data.

Patient data	n	%
Gender		
Male	40	58
Female	29	42
Total	69	100
Transplantation type		
From the living donor	45	65.2
From the cadaveric donor	24	34.8
Total	69	100
Chronic disease		
Yes	19	27.5
None	50	72.5
Total	69	100
Diabetes		
Yes	7	10.1
None	62	89.9
Total	69	100
Hypertension		
Yes	13	18.8
None	56	81.2
Total	69	100
Chronic obstructive pulmonary disease		
Yes	1	1.4
None	68	98.6
Total	69	100
Chronic artery disease		
Yes	1	1.4
None	68	98.6
Total	69	100
Heart failure		
None	69	100
Kidney failure		
Yes	66	95.7
None	3	4.3
Total	69	100
Other chronic disease		
None	67	97.1
Hyperlipidemia	1	1.4
Epilepsy	1	1.4
Total	69	100
ASA score		
ASA II	46	66.7
ASA III	10	14.5
ASA IV	13	18.8
Total	69	100
Type of nutrition		
Oral nutrition	69	100
Complication		
Yes	18	26.1
Sepsis	2	2.9
Primary non function	1	1.4
Wound Infection	6	8.7
Atelectasis	2	2.9
Pneumonia	1	1.4
Intracranial hemorrhage	2	2.9
Amnesia and quadroplegia	1	1.4
Bile leak (because of liver incision or from anastomosis)	2	2.9
Transient kidney failure	1	1.4
None	51	73.9
Total	69	100
Complication management type		
Medical	16	23.2
Monitoring with percutaneous catheter	1	1.4
Temporary dialysis sessions	1	1.4
None	51	74
Total	69	100
Hospital mortality		
Yes	62	89.9
None	7	10.1
Total	69	100
Overall mortality		
Live	54	78.3
Mortal	15	21.7
Total	69	100

ASA: American Society of Anaesthesiologists.

operatively had shorter flatulence times (Table 3). The results of the studies in the literature are in parallel with our results and show that early oral food intake enables early restoration of bowel function and shortens the flatulence time.

The number of studies in the literature demonstrating the effects of early nutrition on patients with liver transplantation is limited, and similar to our results, there are different studies showing that early nutrition shortens the duration of hospital stay.[29-31] Early nutrition may affect the duration of hospital stay by reducing complications.[33] Terzioglu et al. reported that early postoperative nutrition decreased the duration of hospital stay in patients who had gynecological surgery.[31] The results of Zhou et al. and Fanning and Hojat also show that early oral food intake shortens hospital stay.[29,30] Lobato Dias Consoli et al. initiated oral food intake in patients who had undergone colon resection on the first postoperative day. The researchers found that the duration of hospital stay decreased from five days to three days in the group that started oral food intake early.[32] Our study also shows that the patients who received early nutrition had a shorter hospital stay (Table 3).

Our study also shows that women had a shorter flatulence time compared to men. This may be explained by the effects of ovarian hormones on the gastrointestinal system in women.[34]

The effect of early nutrition on complications in the postoperative period is one of the most important concerns. The most common complication observed in our study was wound infection. Especially the patients who started nutrition at the 96th hour had the highest incidence of complications in our study (Table 3). Herbert et al. published a systematic review on the length of hospital stay and postoperative complications in patients who had undergone lower gastrointestinal tract surgery by reviewing 17 randomized controlled trials with 1,437 participants who started nutrition within 24 hours. The researchers reported that the hospital stay was 1.95 days shorter in the patient group who started nutrition within 24 hours. In terms of complications, wound infection was reported in 12 studies, intraabdominal abscess in 6 studies, anastomotic separation in 13 studies and

TABLE 3: Relationship between patients' complication, hospital mortality with postoperative feding time and Relationship between patients' ASA score with hospital mortality.

	Complication		Absense of complication				
Postoperative feeding time (Hours)	**(n)**	**%**	**(n)**	**%**	**Total (n)**	**X^2**	**p value**
24	6	22.22	21	77.78	27	8.879	**0.03**
48	6	19.35	25	80.65	31		
72	1	16.67	5	83.33	6		
96	4	80.00	1	20.00	5		
	Hospital mortality		**Absense of hospital mortality**				
Postoperative feeding time (Hours)	**(n)**	**%**	**(n)**	**%**	**Total (n)**	**X^2**	**p value**
24	2	7.41	25	92.59	27	1.306	0.723
48	4	12.9	27	87.10	31		
72	1	16.67	5	83.33	6		
96	-	-	5	100.00	5		
	Hospital complication		**Absense of hospital complication**				
ASA score	**(n)**	**%**	**(n)**	**%**	**Total (n)**	**X^2**	**p value**
ASA II	4	8.7	42	91.30	46	6.614	**0.03**
ASA III	1	10	9	90	10		
ASA IV	2	15.38	11	84.62	13		

*Chi-square; ASA: American Society of Anaesthesiologists.

TABLE 4: Relationship between postoperative feding time, ASA score with day of gas discharge.

	Gas discharge 1st day		Gas discharge 2nd day		Gas discharge 3rd day				
Postoperative feeding time (Hours)	**(n)**	**%**	**(n)**	**%**	**(n)**	**%**	**Total (n)**	**X^2**	**p value**
24	25	92.59	2	7.41	0	-	27	38.86	**0**
48	29	93.55	2	6.45	0	-	31		
72	0	-	6	100.0	0	-	6		
96	0	-	0		5	100.0	5		
	Gas discharge 1st day		**Gas discharge 2nd day**		**Gas discharge 3rd day**				
ASA score	**(n)**	**%**	**(n)**	**%**	**(n)**	**%**	**Total (n)**	**X^2**	**p value**
ASA II	43	62.32	3	4.35	0	-	46	38.86	**0**
ASA III	9	13.05	1	1.44	0	-	10		
ASA IV	2	2.90	6	8.69	5	7.25	8		

*Chi-square; ASA: American Society of Anaesthesiologists.

pneumonia in 10 studies. It was found that there was no statistically significant difference in terms of complications. Herbert's systematic review reveals that early nutrition does not increase the rate of complications.[24] In a randomized controlled study conducted by Dağ et al. with patients who had undergone colorectal surgery, it was reported that there was no significant difference in the incidence of complications between the two groups, and the hospital stay was shorter in patients who started nutrition early.[34] In a study conducted by Li et al. with patients who had undergone radical gastrectomy, the researchers found that the hospital stay was shorter and there was no

TABLE 5: The relationship between hospital stay, postoperative feeding time and ASA score.

	n	**X^2**	**p value**
Postoperative feeding time			
24	27	9.289	0.026
48	31		
72	6		
96	5		
Total	69		
	n	**X^2**	**p value**
ASA II	46	3.190[b]	0.262
ASA III	10		
ASA IV	13		
Total	69		

*Kruskal-Wallis; ASA: American Society of Anaesthesiologists.

TABLE 6: The relationship between gender and presence of chronic disease, hospital stay, postoperative feeding time and gas discharge time.

	Gender	Median	Z	p value
Postoperative hospital stay	Female	22±80.72	458.500	0.14
	Male	21±90.55		
	Total	21±8595		
Postoperative feeding time	Female	48±27.57	-0.647	0.52
	Male	48±13.53		
	Total	48±20.83		
Gas discharge	Female	1±0.33	-2.366	**0.018**
	Male	1±0.78		
	Total	1±0.59		
Postoperative hospital stay	Chronic disease	21±3.30	-2.607	**0.009**
	Absense of chronic disease	20±154.8		
	Total	21±85.95		
Gas discharge	Chronic disease	1±0.76	-0.747	0.45
	Absense of chronic disease	1±0.51		
	Total	1±0.59		
Postoperative feeding time	Chronic disease	48±24.0	-0.729	0.46
	Absense of chronic disease	48±19.57		
	Total	48±20.83		

*Mann-Whitney U.

TABLE 7: Relationship between survival status, operation time, intubated time, age, and meld scores with variables.

	B	Standard error	β	t value	p value
Live/Mortal					
Complication	-0.268	0.443	-0.280	-0.606	-0.547[b]
Hospital stay	1.098	0.001	0.0	0.002	0.998b
Complication management type	0.732	0.407	0.749	1.799	0.077[b]
Type of complication	0.015	0.022	0.108	0.667	0.507[b]
Surgery time					
Postoperative Feeding time	0.001	0.005	0.023	0.115	0.909[b]
Gas discharge	-0.062	0.168	-0.073	-0.366	0.715[b]
Complication	-0.025	0.163	-0.021	-0.153	0.879[b]
Hospital stay	-0.001	0.2001	-0.094	-0.683	0.497[b]
Time intubated					
Postoperative Feeding time	0.005	0.002	0.346	1.963	0.054[b]
Gas discharge	0.076	0.085	0.160	0.898	0.373[b]
Hospital stay	0.0	0.0	-0.112	-0.908	0.367[b]
Complication	-0.088	0.082	-0.134	-1.071	0.288[b]
Age					
Postoperative Feeding time	-0.005	0.005	-0.198	-1.033	0.306[b]
Gas discharge	0.282	0.282	0.338	1.744	0.086[b]
Hospital stay	0.0	0.0	0.024	0.181	0.857[b]
Complication	-0.240	-0.240	-0.209	-1.530	0.131[b]
Meld points					
Surgery time	-0.002	0.001	-0.282	-1.970	0.056[b]
Time intubated	0.403	0.222	0.501	1.817	0.077[b]
Postoperative Feeding time	-0.003	0.004	-0.168	-0.845	0.404[b]
Gas discharge	-0.023	0.165	-0.033	-0.136	0.892[b]
Hospital stay	0.018	0.135	0.023	0.134	0.894[b]
Complication	0.078	0.118	0.114	0.663	0.511[b]

*Linear regression.

significant difference in terms of complications in patients who started early nutrition.[35] Ikegami et al. reported that bacterial sepsis was less common in donors who started nutrition after liver transplantation, and similarly, Kim et al. reported fewer bacterial infections in donors in the early nutrition group after liver transplantation.[20,21] Rayes et al. reported that early nutrition in patients with liver transplantation reduced bacterial translocation and decreased the incidence of infections after liver transplantation.[22] It seems that early nutrition did not increase the incidence of complications in patients with liver transplantation, donors and in different surgical procedures, and the findings are similar to the present study. We was also found that the duration of hospital stay was prolonged in the patients with chronic diseases. This may be explained by the fact that patients with chronic diseases are a higher risk group in terms of complications and the difficulties related to the optimization of their chronic diseases after surgery.

CONCLUSION

In conclusion, our study showed that early postoperative nutrition shortened the flatulence time and duration of hospital stay and reduced the incidence of complications in patients with liver transplantation. Based on the present study, it can be concluded that early postoperative nutrition is effective and safe for patients with liver transplantation. However, there is a need for more prospective studies demonstrating the effect of early postoperative nutrition on complications and duration of hospital stay in patients with liver transplantation.

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Conflict of Interest

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Authorship Contributions

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REFERENCES

1. El-Gamal S, Morsy WYM, Ismail MS, El-Shazly MAR. Impact of a designed nursing intervention protocol about preoperative liver transplantation care on patients' outcomes at a university hospital in Egypt. Journal of Education and Practice. 2013;4(19):105-16. https://core.ac.uk/reader/234634736
2. Sayın Y. Current practices in surgical nursing. In: Çelik S, ed. Surgical Diseases of the Hepatopancreatobiliary System. 1st ed. Antalya: Çukurova Nobel Medicine Publisher; 2021. p.515-9.
3. Genç R. Türkiye'de ve dünyada organ transplantasyon cerrahisi: transplantasyon lojistiğinin yönetimi [Organ transplantation surgery in Turkey and in the world: the management of transplantation logistics]. Turkish Journal of Surgery. 2009;25(1):40-4. https://turkjsurg.com/full-text-pdf/807/tur
4. Esquivel CO. Liver transplantation: where we are and where we are heading. Transplant Proc. 2010;42(2):610-2. PMID: 20304205.
5. Kasapoğlu B, Yalçın KS, Türkay C. Canlı donörden karaciğer transplantasyonu [Liver transplantation from a living donor]. Current Gastroenterology. 2010;14(2):96-102. https://guncel.tgv.org.tr/journal/33/pdf/353.pdf
6. Black CK, Termanini KM, Aguirre O, Hawksworth JS, Sosin M. Solid organ transplantation in the 21st century. Ann Transl Med. 2018;6(20):409. PMID: 30498736; PMCID: PMC6230860.
7. Türkiye Organ Nakli Vakfı [İnternet]. [Erişim tarihi: 5 Ocak 2023]. İstatistikler. Erişim linki: https://www.tonv.org.tr/tr/organ-bagisi/istatistikler/
8. Sanchez AJ, Aranda-Michel J. Nutrition for the liver transplant patient. Liver Transpl. 2006;12(9):1310-6. PMID: 16933224.
9. Çelebi D, Yılmaz E. Cerrahi hastalarda enteral ve parenteral beslenmede kanıta dayalı uygulamalar ve hemşirelik bakımı [Enteral and parenteral nutrition in surgical patients evidence-based practices and nursing care]. Istanbul Gelisim University Journal of Health Sciences. 2019;7:714-31. https://doi.org/10.38079/igusabder.546979

10. Abunnaja S, Cuviello A, Sanchez JA. Enteral and parenteral nutrition in the perioperative period: state of the art. Nutrients. 2013;5(2):608-23. PMID: 23429491; PMCID: PMC3635216.

11. Kerwin AJ, Nussbaum MS. Adjuvant nutrition management of patients with liver failure, including transplant. Surg Clin North Am. 2011;91(3):565-78. PMID: 21621696.

12. British Transplantation Society. Living Donor Liver Transplantation. 2015. Cited: January 6, 2023. Available from: https://bts.org.uk/wp-content/uploads/2016/09/03_BTS_LivingDonorLiver-1.pdf

13. European Association fort he Study of the Liver (EASL). EASL Clinical practice guidelines: liver transplantation. 2015. Cited: January 6, 2023. Available from: https://easl.eu/wp-content/uploads/2018/10/Liver-Transplantation-English-report.pdf

14. European Comittee (Partial Agreement) on Organ Transplantation, Guide to the quality and safety of organs for transplantation 7th Edition, 2018. Available at: https://deputyprimeminister.gov.mt/en/hcs/Documents/Tissues%20Cells%20and%20Organs/Guide_to_the_Quality_and_Safety_of_Organs_for_Transplantation.pdf Accessed January 6, 2023. (Linke erişim sağlanamamaktadır, kaynağa direkt ulaşılacak link eklenerek erişim tarihi güncellenmelidir.

15. ERAS Türkiye Derneği [İnternet]. [Erişim tarihi: 29 Mart 2023]. ERAS protokollerinin temel ögeleri. Erişim linki: https://eras.org.tr/page.php?id=10 Accesssed

16. Brustia R, Monsel A, Skurzak S, Schiffer E, Carrier FM, Patrono D, et al. Guidelines for perioperative care for liver transplantation: Enhanced Recovery After Surgery (ERAS) Recommendations. Transplantation. 2022;106(3):552-61. PMID: 33966024.

17. Feltracco P, Barbieri S, Galligioni H, Michieletto E, Carollo C, Ori C. Intensive care management of liver transplanted patients. World J Hepatol. 2011;3(3):61-71. PMID: 21487537; PMCID: PMC3074087.

18. Yirui L, Yin W, Juan L, Yanpei C. The clinical effect of early enteral nutrition in liver-transplanted patients: a systematic review and meta-analysis. Clin Res Hepatol Gastroenterol. 2021;45(3):101594. PMID: 33887541.

19. Fuentes Padilla P, Martínez G, Vernooij RW, Urrútia G, Roqué I Figuls M, Bonfill Cosp X. Early enteral nutrition (within 48 hours) versus delayed enteral nutrition (after 48 hours) with or without supplemental parenteral nutrition in critically ill adults. Cochrane Database Syst Rev. 2019;2019(10):CD012340. PMID: 31684690; PMCID: PMC6820694.

20. Kim JM, Joh JW, Kim HJ, Kim SH, Rha M, Sinn DH, et al. Early enteral feeding after living donor liver transplantation prevents infectious complications: a prospective pilot study. Medicine (Baltimore). 2015;94(44):e1771. PMID: 26554774; PMCID: PMC4915875.

21. Ikegami T, Shirabe K, Yoshiya S, Yoshizumi T, Ninomiya M, Uchiyama H, et al. Bacterial sepsis after living donor liver transplantation: the impact of early enteral nutrition. J Am Coll Surg. 2012;214(3):288-95. PMID: 22244203.

22. Rayes N, Seehofer D, Hansen S, Boucsein K, Müller AR, Serke S, et al. Early enteral supply of lactobacillus and fiber versus selective bowel decontamination: a controlled trial in liver transplant recipients. Transplantation. 2002;74(1):123-7. PMID: 12134110.

23. Usui M, Hayasaki A, Fujii T, Iizawa Y, Kato H, Tanemura A, et al. Early enteral feeding of daikenchuto stimulates early bowel movement with increased portal venous blood flow after living donor liver transplantation. Transplant Proc. 2018;50(9):2690-4. PMID: 30401378.

24. Herbert G, Perry R, Andersen HK, Atkinson C, Penfold C, Lewis SJ, et al. Early enteral nutrition within 24 hours of lower gastrointestinal surgery versus later commencement for length of hospital stay and postoperative complications. Cochrane Database Syst Rev. 2018;10(10):CD004080. Update in: Cochrane Database Syst Rev. 2019;7:CD004080. PMID: 30353940; PMCID: PMC6517065.

25. Doyle DJ, Hendrix JM, Garmon EH. American Society of Anesthesiologists Classification. 2023 Aug 17. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. PMID: 28722969.

26. Türk Karaciğer Araştırmaları Derneği [İnternet]. [Erişim linki: 31 Mart 2024]. MELD Hesapla. Erişim linki: https://www.tkad.org.tr/meld-hesapla/

27. Weimann A, Braga M, Carli F, Higashiguchi T, Hübner M, Klek S, et al. ESPEN practical guideline: clinical nutrition in surgery. Clin Nutr. 2021;40(7):4745-61. PMID: 34242915.

28. Mahmoodzadeh H, Shoar S, Sirati F, Khorgami Z. Early initiation of oral feeding following upper gastrointestinal tumor surgery: a randomized controlled trial. Surg Today. 2015;45(2):203-8. PMID: 24875466.

29. Fanning J, Hojat R. Safety and efficacy of immediate postoperative feeding and bowel stimulation to prevent ileus after major gynecologic surgical procedures. J Am Osteopath Assoc. 2011;111(8):469-72. PMID: 21862754.

30. Zhou T, Wu XT, Zhou YJ, Huang X, Fan W, Li YC. Early removing gastrointestinal decompression and early oral feeding improve patients' rehabilitation after colorectostomy. World J Gastroenterol. 2006;12(15):2459-63. PMID: 16688845; PMCID: PMC4088090.

31. Terzioglu F, Şimsek S, Karaca K, Sariince N, Altunsoy P, Salman MC. Multimodal interventions (chewing gum, early oral hydration and early mobilisation) on the intestinal motility following abdominal gynaecologic surgery. J Clin Nurs. 2013;22(13-14):1917-25. PMID: 23581478.

32. Lobato Dias Consoli M, Maciel Fonseca L, Gomes da Silva R, Toulson Davisson Correia MI. Early postoperative oral feeding impacts positively in patients undergoing colonic resection: results of a pilot study. Nutr Hosp. 2010;25(5):806-9. PMID: 21336439.

33. Heitkemper MM, Chang L. Do fluctuations in ovarian hormones affect gastrointestinal symptoms in women with irritable bowel syndrome? Gender Medicine. 2009;6:152-67. https://doi.org/10.1016/j.genm.2009.03.004

34. Dag A, Colak T, Turkmenoglu O, Gundogdu R, Aydin S. A randomized controlled trial evaluating early versus traditional oral feeding after colorectal surgery. Clinics (Sao Paulo). 2011;66(12):2001-5. PMID: 22189721; PMCID: PMC3226591.

35. Li B, Liu HY, Guo SH, Sun P, Gong FM, Jia BQ. The postoperative clinical outcomes and safety of early enteral nutrition in operated gastric cancer patients. J BUON. 2015;20(2):468-72. PMID: 26011337.