

Effect of calcium dobesilate on liver regeneration in rats undergoing partial hepatectomy

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ABSTRACT

BACKGROUND: To date, no study has evaluated the effects of calcium dobesilate on regenerative capacity after partial hepatectomy. Within the scope of this research, we aimed to elucidate the effects of calcium dobesilate (CD) on liver regeneration capacity and antioxidant pathways after partial hepatectomy.

METHODS: Thirty-six Sprague Dawley male rats weighing between 250-350 grams were used in the study. All animals underwent partial hepatectomy. The rats were randomly divided into four groups, each consisting of nine rats, as control groups (Groups 1 and 2) and study groups (Groups 3 and 4). Regeneration rate, histopathological parameters, immunohistochemical examination, and the apoptotic index (AI) were measured.

RESULTS: Tissue superoxide dismutase (SOD) levels were statistically significantly higher in the calcium dobesilate study groups compared to controls ($p=0.03$). Malondialdehyde (MDA) levels were statistically significantly higher in the study groups than in the control groups on both the second and seventh days ($p<0.001$). The regeneration rate (RR) was higher in the study group compared to the control group on the second day, and this difference was statistically significant ($p<0.001$). RR was also significantly higher in the study group on the second day compared to the seventh day ($p<0.001$). According to the Suzuki Scoring System, vacuolization and necrosis were not observed in the study groups ($p<0.001$ vs. $p=0.034$, respectively). The apoptotic index was significantly higher in the control groups compared to the study groups ($p<0.001$), and AI was statistically significantly lower on the seventh day ($p=0.006$). Ki-67 expression was statistically significantly higher in the groups receiving CD treatment on both the second and seventh days. In the control groups, Ki-67 expression was statistically significantly higher on the seventh day compared to the second day ($p=0.006$).

CONCLUSION: This research indicated the effects of calcium dobesilate on improving oxidative damage and liver regeneration in rats undergoing partial hepatectomy. The results of the present study showed that (preoperative-postoperative) CD improves oxidative stress and increases liver regeneration capacity after partial hepatectomy.

Keywords: Calcium dobesilate; liver regeneration; oxidative damage; partial hepatectomy; experimental.

INTRODUCTION

Partial hepatectomy (PH) is frequently used in the treatment of liver tumors and in donors for organ transplantation. Studies using the PH model have shown that many factors influence the formation of the regenerative response.^[1] Liver regeneration after PH is associated with the activation of inflammatory

signaling molecules and the induction of oxidative stress.^[2] PH, the model that most clearly demonstrates liver regeneration capacity, is considered the most potent stimulator of liver regeneration. PH stimulates DNA replication, and mitosis accelerates immediately afterward. Significant regeneration occurs within the first 10 days, and this process is completed in 4-5 weeks. Unlike humans, it takes 7-10 days for the rat liver to

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regenerate and return to normal.^[3]

Calcium dobesilate (CD) (2,5 dihydroxybenzenesulfonate) is a pharmacological agent with angioprotective, anti-inflammatory, and antioxidant properties. The antioxidant and anti-inflammatory properties of CD are associated with decreased lipid peroxidation (LPO) caused by free oxygen radicals (FOR) and reduced inflammatory cytokine release, such as platelet-activating factor (PAF). It has also been shown that CD improves microvascular dysfunction, reduces FOR, and increases endothelial nitric oxide (eNO) synthesis.^[4] CD, known to have angioprotective and antioxidant effects and to increase endothelial nitric oxide (NO), may positively affect liver regeneration.^[5]

The impact of CD on regenerative capacity during the post-hepatectomy period remains unexplored. Within the scope of this research, we aimed to elucidate the effects of CD on liver regeneration capacity and antioxidant pathways after PH.

MATERIALS AND METHODS

This experimental study was conducted at Sakarya University's Experimental Medicine Applications and Research Center. It was initiated after approval from the Sakarya University Animal Experiments Local Ethics Committee, with protocol number 36 dated 02/10/2019. The principles regarding the care and use of laboratory animals included in the Declaration of Helsinki were applied throughout the study.

Thirty-six Sprague Dawley male rats weighing between 250 and 350 grams were used in the study. The rats were randomly divided into four groups, each consisting of nine rats.

• Control Groups:

- o Group 1: Planned as the control group of Group 3. Saline (2 ml/day) was administered by oral gavage as the first dose 2 hours before the operation.
- o Group 2: Planned as the control group of Group 4. Saline (2 ml/day) was administered by oral gavage as the first dose 2 hours before the operation.

• Study Groups:

- o Group 3: Planned as a two-day study group. CD was administered by oral gavage at a dose of 100 mg/kg/day, given 2 hours before the operation.
- o Group 4: Planned as a seven-day study group. CD was administered by oral gavage at a dose of 100 mg/kg/day, given 2 hours before the operation.

At the end of two hours, all rats were anesthetized with intraperitoneal ketamine (50 mg/kg) and xylazine (10 mg/kg). A laparotomy with a 2 cm midline incision was performed in all rats. The pedicles of the left lateral and median lobes of the liver were ligated with 3/0 polyglactin, and PH was performed as described by Higgins and Anderson.^[6] The removed liver tissue was weighed, and its weight was recorded. Saline (2

ml/day) was given to Group 1, and 100 mg/kg/day CD was given to Group 3 via oral gavage for two days postoperatively. Saline (2 ml/day) was given to Group 2, and 100 mg/kg/day CD was given to Group 4 via oral gavage for seven days postoperatively.

Groups 1 and 3 underwent relaparotomy under intraperitoneal anesthesia at the end of the second day, and Groups 2 and 4 at the end of the seventh day. An average of 1.5 ml of blood was collected into a standard biochemistry tube for biochemical analysis. Afterwards, a high volume of 0.09% NaCl was administered to the aorta with the help of an intracatheter for liver perfusion. After liver perfusion was achieved, a high volume of blood was collected from the abdominal aorta, and sacrifice was achieved through hypovolemia. The remaining liver tissue was removed without compromising its integrity and weighed. Some liver tissue was stored at -80°C until the day of analysis for superoxide dismutase (SOD), glutathione (GSH), and malondialdehyde (MDA) measurements. The remaining liver tissue samples were fixed in 10% buffered formalin for histopathological examination.

Biochemical Parameters

Biochemical evaluation was performed at the Sakarya University Biochemistry Department Laboratory. Oxidative damage was assessed by measuring GSH, SOD, and MDA levels in liver tissue samples and serum. Rat Superoxidase Dismutase ELISA (enzyme-linked immunosorbent assay) Kit, Rat Malondialdehyde ELISA Kit, and Glutathione ELISA Kit (YLBiont®) were used to evaluate parameters in both tissue and serum.

Regeneration Rate (RR)

The 70% liver tissue resected during hepatectomy was weighed, and the total liver weight was calculated as follows: "Resected tissue (g) = 0.70 × initial total liver weight (g)." Using this formula, the liver weights of all rats before resection were estimated. At 2 and 7 days after PH, the remnant liver tissue was removed and weighed after sacrifice. The regeneration rate was calculated using the formula "Liver regeneration rate (%) = Remnant liver weight / Total liver weight × 100." This formula is known as the Kwon formula.^[7]

Histological and Immunohistochemical Evaluation

Histological and immunohistochemical examinations of the liver tissues were performed at the Sakarya University Medical Faculty Histology and Embryology Department Laboratory. The Suzuki Scoring System was used for histopathological examinations.^[8]

The evaluated parameters included histopathological changes in the liver assessed with hematoxylin-eosin (HE) and Masson trichrome (MTT) staining, apoptotic index (AI) determined by TUNEL (terminal deoxynucleotidyl transferase-mediated dUTP nick end labeling) staining, and Ki-67 expression assessed by immunohistochemical staining. The apoptotic index with TUNEL staining was calculated as AI = (apoptotic cell count / total cell count) × 100.

Statistical Analysis

Data collected within the scope of the study were analyzed using the IBM Statistical Package for the Social Sciences (SPSS) for macOS version 30.0 (IBM Corp., Armonk, NY). Frequency and percentage were used for categorical data, and mean and standard deviation for continuous data as descriptive values. The normality of variables was evaluated using the Shapiro-Wilk test. Multivariate analysis of variance (Multivariate ANOVA) was used to evaluate whether there were differences in biochemical measurements, regeneration rate, apoptotic index, and Ki-67 measurements between rats in the study and control groups with different treatment durations. The chi-square test was used to compare categorical variables. Results were considered statistically significant when the p value was less than 0.05.

RESULTS

The distribution of SOD, GSH, and MDA measurements in the serum and tissue of rats in the experimental and control groups with different treatment periods is shown in Table 1. Upon examination of the table, statistically significant differences were found in tissue SOD and tissue MDA measurements ($p < 0.05$). In tissue SOD measurements, statistically significant differences were observed between the study group and the control group at different treatment times, while no statistically significant differences were observed in the interaction between group and treatment time. The tissue SOD value in the study group was higher than that in the control group, and the measurements on the second day were higher than those on the seventh day. Similarly, in tissue MDA measurements, a statistically significant difference was observed between the study group and the control group at different treatment times, while no statistically significant difference was observed in the interaction between group and treatment time. The tissue MDA value in the study group was higher than that in the control group, and the measurements on day 2 were higher than those on day 7. No statistically significant differences were observed in other serum and tissue measurements between groups and treatment times.

The distribution of regeneration rates, apoptotic indices, and Ki-67 measurements in the study and control groups of rats with different treatment durations is shown in Table 2. Upon examination of the table, statistically significant differences were observed between the study and control groups, between different treatment times, and in the interaction between group and treatment time in terms of regeneration rate and Ki-67 measurements ($p < 0.05$). For apoptotic index measurements, statistically significant differences were observed between the study group and the control group and between different treatment times; however, no statistically significant differences were observed in the interaction between group and treatment time.

In terms of regeneration rate, the values in the study group were higher than those in the control group, and the mea-

Table 1. Distribution of biochemical measurements between groups

Parameters	Group	Time	Mean \pm SD	p-value
Serum SOD	Control	2nd day	3.7 \pm 0.5	0.505
		7th day	4.8 \pm 2.8	
	Study	2nd day	3.2 \pm 0.6	
		7th day	4.3 \pm 2.2	
	Group			
	Time			
Group*Time				
Tissue SOD	Control	2nd day	2.2 \pm 0.6	0.003
		7th day	1.2 \pm 0.3	
	Study	2nd day	3.1 \pm 1.1	
		7th day	2 \pm 0.8	
	Group			
	Time			
Group*Time				
Serum GSH	Control	2nd day	667.4 \pm 156	0.665
		7th day	520.2 \pm 165	
	Study	2nd day	592.9 \pm 98.7	
		7th day	535 \pm 278.9	
	Group			
	Time			
Group*Time				
Tissue GSH	Control	2nd day	3.7 \pm 0.5	0.505
		7th day	4.8 \pm 2.8	
	Study	2nd day	3.2 \pm 0.6	
		7th day	4.3 \pm 2.2	
	Group			
	Time			
Group*Time				
Serum MDA	Control	2nd day	0.4 \pm 0.2	0.223
		7th day	0.4 \pm 0.2	
	Study	2nd day	0.3 \pm 0.2	
		7th day	0.3 \pm 0.1	
	Group			
	Time			
Group*Time				
Tissue MDA	Control	2nd day	0.7 \pm 0.1	0.001
		7th day	0.4 \pm 0.2	
	Study	2nd day	1.2 \pm 0.5	
		7th day	0.8 \pm 0.3	
	Group			
	Time			
Group*Time				

Table 2. Distribution of intergroup regeneration rate, apoptotic index, and Ki-67 measurements

Parameters	Group	Time	Mean±SD	p-value
Regeneration Rate	Control	2nd day	0.50±0.05	
		7th day	0.53±0.04	
	Study	2nd day	0.70±0.13	
		7th day	0.55±0.05	
	Group			<0.001
	Time			0.014
Group*Time			<0.001	
Apoptotic Index	Control	2nd day	35.9±4.5	
		7th day	34.6±4.7	
	Study	2nd day	15.8±2.4	
		7th day	10±1.5	
	Group			<0.001
	Time			0.005
Group*Time			0.071	
Ki-67	Control	2nd day	11.8±1.6	
		7th day	12.7±1.6	
	Study	2nd day	27±1.1	
		7th day	32.6±3.8	
	Group			<0.001
	Time			<0.001
Group*Time			0.004	

measurements on the second day were higher than those on the seventh day. In the combined effect of groups and treatment times, the rates were higher on day 2 in the study group and on day 7 in the control group.

For the apoptotic index measurements, the values in the control group were higher than those in the study group, and the measurements on the second day were higher than those on the seventh day. TUNEL-positive stained cells are shown in Figure 1.

Regarding Ki-67 values, the measurements in the study group were higher than those in the control group, and the values on day 7 were higher than those on day 2. In the combined effect of groups and treatment times, the measurements on day 7 were higher in both the study and control groups. Cells stained by immunohistochemical (IHC) staining for Ki-67 are shown in Figure 2.

When histopathological changes were graded according to the Suzuki Scoring System,^[8] the distribution of sinusoidal obstruction, necrosis, and vacuolization in the experimental and control groups is shown in Table 3. Upon examination of the table, a statistically significant relationship was observed between the groups in all histopathological results ($p<0.05$). Sinusoidal obstruction was observed in groups 0 and 1 in the experimental group and in groups 2 and 3 in the control group. Similarly, necrosis and vacuolization were observed in all rats in the experimental group, while necrosis was observed in groups 0, 1, and 2 in the control group, and vacuolization was observed in groups 0 and 1.

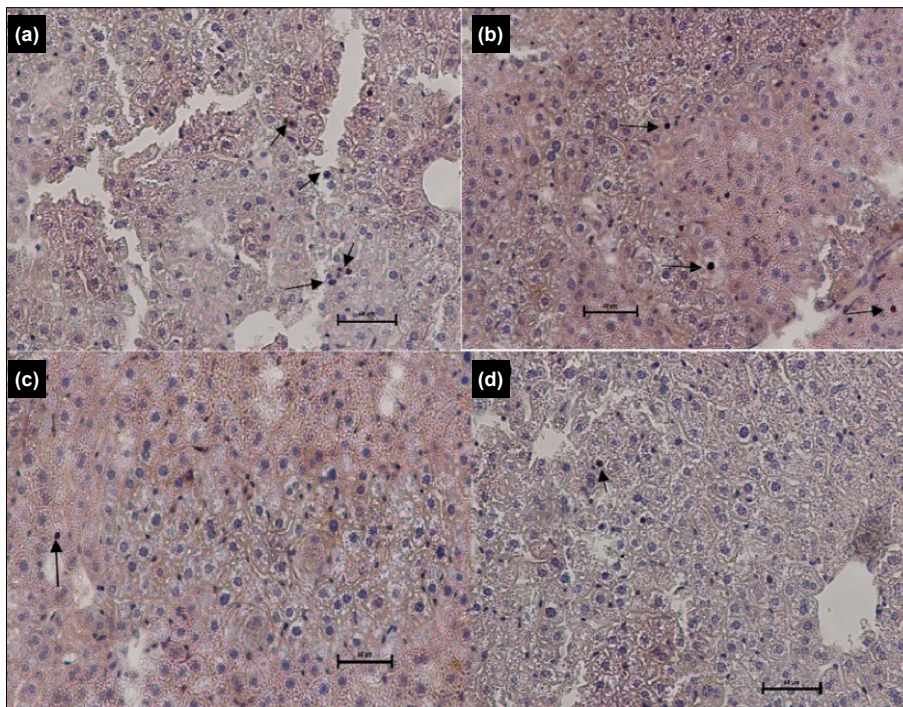


Figure 1. TUNEL cell staining. TUNEL-positive cells are marked with black arrows. (a) and (b): Control groups (Groups 1 and 2, respectively), showing more TUNEL-positive cells. (c) and (d): Calcium dobesilate-treated groups (Groups 3 and 4), showing fewer TUNEL-positive cells.

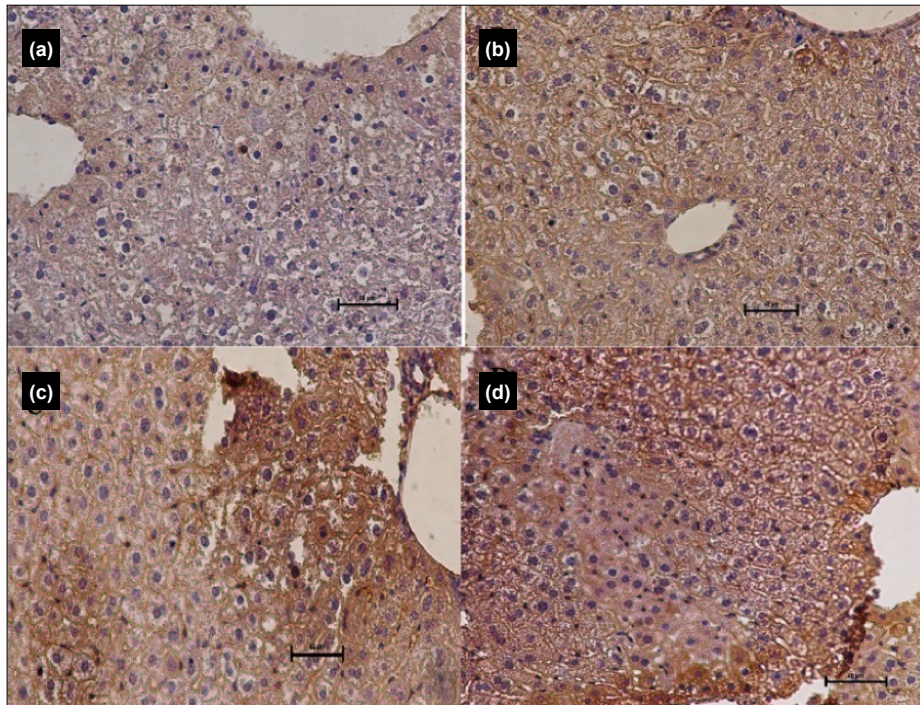


Figure 2. Ki-67 immunohistochemical staining (200× magnification). Cells showing division activity are observed as brown-stained (Ki-67-positive). (a) and (b): Groups 1 and 2, respectively. (c) and (d): Groups 3 and 4.

Table 3. Distribution of histopathological findings between groups

Parameters	Control n (%)	Study n (%)	p-value
Sinusoidal congestion			<0.001
0	0 (0)	10 (55.6)	
1	0 (0)	8 (44.4)	
2	9 (50)	0 (0)	
3	9 (50)	0 (0)	
Necrosis			<0.001
0	5 (27.8)	18 (100)	
1	12 (66.7)	0 (0)	
2	1 (5.6)	0 (0)	
Vacuolization			0.034
0	14 (77.8)	18 (100)	
1	4 (22.2)	0 (0)	

DISCUSSION

Partial hepatectomy, the model that most clearly demonstrates liver regeneration capacity, is considered the most potent stimulator of liver regeneration.^[9,10] Therefore, the partial hepatectomy model was chosen. Weight measurement, proliferating cell nuclear antigen (PCNA), and the mi-

totic index are the most commonly used parameters for the evaluation of liver regeneration. In our study, we selected the regeneration weight ratio (according to the Kwon formula), mitotic count, and Ki-67 proliferation index for evaluating regeneration, as these are the most widely used parameters in the literature.

To prevent oxidative damage, mammalian cells have developed an elaborate antioxidant defense system that includes enzymatic activities such as superoxide dismutase, catalase, and glutathione peroxidase/reductase. Studies conducted on various tissues have shown that CD acts as a radical scavenger, reduces FOR, increases eNOS, and decreases LPO.^[11,12] However, there is no study in the literature evaluating the effect of CD treatment on liver regeneration in the PH model.

Karaman et al.^[13] investigated the effect of leflunomide, an antioxidant and anti-inflammatory agent, on liver regeneration in the PH model; on day 2, liver tissue SOD values were higher in the PH+leflunomide group than in the group treated with PH alone. The current findings are consistent with those observed in the second-day study and control groups. In the study by Kanter et al.,^[14] quercetin treatment, a flavonoid, was evaluated. When the effect of quercetin on liver regeneration in the PH model was examined by comparing the PH+quercetin and PH groups, the seventh-day tissue SOD value was higher in the PH+quercetin group than in the PH group alone. These findings are similar to the seventh-day tissue SOD values in our study. The tissue SOD value was high-

er in the seven-day study group than in the control group, and this effect was even more pronounced in the two-day study group compared to the control group, indicating that CD may be effective on the enzymatic antioxidant defense system and may benefit regeneration. Özden et al.^[15] evaluated the effect of hyperbaric oxygen (HBO) treatment on liver regeneration; tissue SOD values were compared on days 2, 4, and 7, and it was shown that tissue SOD values in the PH-only group were lower from day 2 to day 7, while these values increased from day 2 to day 7 with HBO treatment. Similar results were found in our study in terms of tissue SOD values. The antioxidant enzyme levels decreased in the control groups due to an increase in superoxide anions from day 2 to day 7, and the increased SOD levels after treatment with CD suggest that this treatment provides support to the antioxidant system. In our study, serum SOD values increased from the second day to the seventh day in the control groups and did not increase in the study groups receiving CD treatment. Enzyme results showed opposite trends in tissue and serum in both the control and study groups. In a study conducted by Saitoh et al.,^[16] changes in tissue and plasma levels of SOD were investigated in a burn rat model, and SOD values in different tissues at various times were compared with plasma values during the same periods; different plasma and SOD values that increased at different time points were recorded for each tissue.

Free oxygen radicals attack polyunsaturated fatty acids in membrane lipids and lead to lipid peroxidation. Elevated MDA concentrations in tissue and plasma are well-known hepatocyte damage markers reflecting the level of LPO. Although LPO may be a primary toxicity mechanism for cell membrane damage, it is also a physiological process. It is known that LPO begins to appear at a very early stage of liver regeneration.^[17] In light of these findings, as it is known that treatments with antioxidant properties prevent LPO in liver tissue, tissue MDA levels were expected to be lower in the groups receiving treatment in our study. However, tissue MDA levels were higher in both the study and control groups. The effects of peroperative and preoperative CD use on regeneration in a hepatic ischemia-reperfusion (I/R) injury model were evaluated by Ünal et al.^[18] In that study, total sulfhydryl (SH) levels, MDA, and fluorescent oxidation products (FOP) were measured as oxidative stress parameters, and the highest MDA levels were found in the control group. The authors concluded that preoperative and peroperative CD treatment significantly reduced liver tissue MDA levels. Although an I/R injury model was used, the CD-related reduction in tissue MDA levels showed an opposite trend in our study. However, serum MDA levels in our study were lower in the groups receiving treatment than in those undergoing PH alone, regardless of the day of measurement.

In a study conducted by Andersen et al.,^[19] PH was applied to healthy rats to systematically examine the natural course of liver regeneration. They reported that PH induced a rapid regenerative response at a maximum rate between days 1

and 4, and that liver regeneration was completed by day 8. Again, in the same study, it was observed that liver regeneration rate (RO) showed a stable increasing course until day 7 after PH and reached its final peak on day 7, albeit with lower acceleration. Our results in the control groups are consistent with the literature in this respect, as the regeneration rate increased from day 2 to day 7. The RO of the treated groups was higher. The difference between the ROs of the control and study groups on days 2 and 7 is thought to be due to CD and its contribution to liver regeneration.

The Suzuki Scoring System was used for histopathological grading in our study. Ünal et al.^[18] used the same scoring system in their study evaluating the effects of CD on hepatic I/R injury, and reported that CD significantly reduced sinusoidal congestion scores, that there was no significant difference in vacuolization scores, and that necrosis was not observed in any group. Oğuz et al.^[20] investigated the effect of *Urtica dioica* (UD) on regeneration in the PH model and found that vacuolization was widespread in the PH group on the seventh day, while sinusoids were larger than those in the PH+UD group. In our study, sinusoidal congestion was absent or mild in the study groups, vacuolization and necrosis were not observed, and all findings were statistically significant for all variables. These results suggest that CD protects liver tissue during regeneration and helps to form a histological structure more similar to normal liver tissue.

The role of apoptosis in the liver after hepatectomy is controversial. Apoptosis begins at the peak of regeneration. Li et al.^[21] showed that the level of apoptosis after liver regeneration is directly proportional to the level of regeneration. In another study, Kırımlıoğlu et al.^[22] showed increased apoptosis after PH in rats. We did not find any study in the literature evaluating the effect of CD on hepatic regeneration and apoptosis. Sowa et al.^[23] evaluated apoptosis on the second and seventh days after 70% PH and showed that apoptosis occurred earlier and in parallel with regeneration. Their outcomes were consistent with our study in terms of time selection. Our findings in the control groups are also consistent with the literature. Kanter et al.^[14] compared PH+quercetin and PH groups in their study and found that the seventh-day AI value was lower in the PH+quercetin group than in the PH-only group. In our study, the CD group had lower AI values on the second and seventh days than the control groups. This result suggests that CD may reduce cell damage after PH.

Karaman et al.^[13] evaluated the KI-67 proliferation index in terms of liver regeneration on the second day after PH in their study with leflunomide; Ki-67 proliferation index values were significantly higher in the PH+leflunomide group compared to the PH group. They concluded that leflunomide use after PH probably increased liver regeneration through its antioxidant effect. These findings are in line with our results, although the agents used for treatment differ. CD increases cell proliferation in tissue repair and supports regeneration.

CONCLUSION

In our study, the effects of calcium dobesilate on oxidative damage and liver regeneration in rats undergoing PH were evaluated using biochemical and histological methods. The increased tissue SOD levels after calcium dobesilate treatment suggest that this treatment provides support to the antioxidant system and contributes to liver regeneration. In addition, histopathological examination under light microscopy showed decreased sinusoidal congestion and vacuolization with calcium dobesilate treatment, supporting its potential benefit in regeneration and its protective effect on liver tissue. Furthermore, calcium dobesilate was observed to effectively suppress the tendency for apoptosis after PH and thus significantly contribute to regeneration.

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Use of AI for Writing Assistance: The authors used AI and AI-assisted Technologies (Grammarly and MS Word Editor) in the writing process. These technologies improved the readability and language of the work. Still, they did not replace key authoring tasks such as producing scientific or medical insights, drawing scientific conclusions, or providing clinical recommendations. The authors are ultimately responsible and accountable for the contents of the whole work.

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DENEYSEL ÇALIŞMA - ÖZ

Parsiyel hepatektomi yapılan sıçanlarda kalsiyum dobesilatın karaciğer rejenerasyonu üzerine etkisi

AMAÇ: Bugüne kadar hiçbir çalışma, kalsiyum dobesilatın parsiyel hepatektomi sonrası rejeneratif kapasite üzerindeki etkilerini değerlendirmemiştir. Bu araştırma kapsamında, kalsiyum dobesilatın (KD) parsiyel hepatektomi sonrası karaciğer rejenerasyon kapasitesi ve antioksidan yolları üzerindeki etkilerini açıklamayı amaçladık.

GEREÇ VE YÖNTEM: Çalışmada 250 ile 350 gram ağırlığında otuz altı Sprague Dawley erkek sıçan kullanıldı. Tüm hayvanlara parsiyel hepatektomi uygulandı. Sıçanlar rastgele dört gruba ayrıldı, her grup kontrol grubu (Grup 1 ve 2) ve çalışma grubu (Grup 3 ve 4) olmak üzere 9 sıçandan oluşuyordu. Rejenerasyon oranı, histopatolojik parametreler, immünohistokimyasal inceleme ve apoptotik indeks (AI) ölçüldü.

BULGULAR: Doku süperoksit dismutaz (SOD) seviyesi, çalışma gruplarında kontrol gruplarına kıyasla istatistiksel olarak anlamlı derecede yüksekti ($p=0.03$). Çalışma gruplarında malondialdehit (MDA) hem 2. hem de 7. günde kontrol gruplarına kıyasla istatistiksel olarak anlamlı derecede yüksekti ($p=0.001$). İkinci günde rejenerasyon oranı (RO), çalışma grubunda kontrol grubuna kıyasla daha yüksekti ve bu fark istatistiksel olarak anlamlıydı ($p<0.001$). İkinci günde RO, KD grubunda 7. gün grubuna kıyasla anlamlı derecede yüksekti ($p<0.001$). Suzuki skorlama sistemine göre çalışma gruplarında vakuolizasyon ve nekroz gözlenmedi (sırasıyla, $p<0.001$ 'e karşı $p=0.034$). Apoptotik indeks (AI), kontrol gruplarında çalışma gruplarına kıyasla anlamlı derecede yüksekti ($p<0.001$) ve AI, 7. günde istatistiksel olarak anlamlı derecede düştü ($p=0.006$). Ki67 ekspresyonu çalışma gruplarında 2. ve 7. günde istatistiksel olarak anlamlı derecede yüksekti. Kontrol gruplarında 7. günde 2. güne göre istatistiksel olarak anlamlı derecede daha yüksekti ($p=0.006$).

SONUÇ: Bu araştırma, kalsiyum dobesilatın parsiyel hepatektomi uygulanan sıçanlarda oksidatif hasarı iyileştirme ve karaciğer rejenerasyonunu artırma üzerindeki etkilerini ortaya koymuştur. Mevcut çalışmanın sonuçları (ameliyat öncesi ve sonrası), KD'nin parsiyel hepatektomi sonrası oksidatif stresi iyileştirdiğini ve karaciğer rejenerasyon kapasitesini artırdığını göstermiştir.

Anahtar sözcükler: Deneysel; kalsiyum dobesilat; karaciğer rejenerasyonu; oksidatif hasar; parsiyel hepatektomi.

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