Effect of Diabetes Mellitus on short-term prognosis of 227 pyogenic liver abscess patients after hospitalization

Zhaoqing Du
Xi'an Jiaotong University
Xinchen Zhou
Xi'an Jiaotong University
Junzhou Zhao
Xi'an Jiaotong University
Jianbin Bi
Xi'an Jiaotong University
Yifan Ren
Xi'an Jiaotong University
Jia Zhang
Xi'an Jiaotong University
Yuxin Lin
Xi'an Jiaotong University
Zheng Wu
Xi'an Jiaotong University
Yi lV
Xi'an Jiaotong University
XuFeng Zhang
Xi'an Jiaotong University
Rongqian Wu (rwu001@mail.xjtu.edu.cn)
National Local Joint Engineering Research Center for Precision Surgery & Regenerative Medicine
https://orcid.org/0000-0003-0993-4531

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Abstract

Background: Pyogenic liver abscess (PLA) is an inflammatory disease with increasing incidence. When it occurs with diabetes mellitus (DM), risk of recurrence and the mortality may increase. However, the effect of DM on short-term prognosis of PLA patients after hospitalization remained unknown.

Methods: 227 PLA patients who received treatment at the First Affiliated Hospital of Xi'an Jiaotong University from January 2011 to January 2018 were retrospectively enrolled. They were divided into two groups as DM group (n=61) and Non-DM group (n=166). In the DM group, HbA1C level <7% was considered to be good-control of glycaemia (n=23). The clinical characteristics and overall short-term survivals were analyzed.

Results: The proportion of PLA patients with DM was 26.87%. In the DM group, there was a higher incidence of hypertension and Candida spp. infection. Conservative administration and percutaneous drainage were mainly used in patients with good- (60.87%) and poor-control (60.53%) of glycaemia, respectively. During follow-up, 24 (10.57%) died due to uncontrolled systemic infections and other serious complications. Compared with PLA patients without DM, patients in the DM group had significantly increased 6-month mortality rate after discharge (Log-Rank test, P =0.021). Poor-control of glycaemia did not reduce the six-month survival, while the recurrence rate of PLA within three months showed an almost 3-fold increase (13.16% vs. 4.35%). Further multivariate analyses found that DM was the only independent risk factor for the PLA six-month survival (odd ratio [OR]: 0.097, 95% confidence interval [CI]: 0.018-0.526, P =0.007). However, the blood glucose level had no significant effect on the short-term survival of PLA patients with DM (Log-Rank test, P =0.218).

Conclusions: In PLA patients, DM aggravated short-term mortality and blood glucose levels should be well controlled.

Background

Pyogenic liver abscess (PLA), as a serious infectious disease occurs in liver parenchyma, has shown a trend of increasing incidence and high mortality recently [1]. Researchers found that PLA had different prevalence in general population over the world, with a ranging from 3.6 per 10,000 population [2] in Europe and Americas to 17.6–86 per 10,000 population [1, 3] in Asia. Because it can cause fatal systemic infections, mortality rate of PLA within 30 days of hospitalization can be as high as 10% [4]. Especially in the case of combining high risk factors or underlying conditions, it may be easier to induce serious complications and worsen prognosis [5].

PLA patients with DM is a relatively popular situation, the rate can be up to 35.3% [4]. Meanwhile, DM status may easier result in severe complications and recurrent [6]. In addition, poor-control of blood glucose may aggravate the situation and prognosis [7]. However, the clinical characteristics and short-term survival between PLA patients with and without DM have not been fully discussed before, especially in northwest China. Moreover, rare research has been published about the effect of blood glycaemic

control on these aspects of PLA patients with DM. In this study, we conducted a retrospective study on PLA patients with or without DM, and with good or poor control of blood glucose level, comparing their clinical characteristics and short-term survivals, which might help improving the diagnosis and prognosis of PLA patients with DM and provide clues of the effect of glycaemic control.

Patients And Methods

Patients

In this retrospective study, we examined the patients who were diagnosed primarily as PLA in the First Affiliated Hospital of Xi'an Jiaotong University between January 2011 to January 2018. All diagnoses of PLA were based on the clinical features, imaging and laboratory results, blood and *pus* cultures. Details of 422 patients were retrieved through the hospital's electronic medical record system. Patients with the following conditions were excluded: those who were diagnosed malignant tumors or other serious cardiovascular diseases, those who were not the first time suffering from liver abscess, those who had not finished the hospitalization in our center and those who had incomplete medical records or a 180 days follow-up. Finally, 227 patients entered this study. Patients were firstly divided into two groups based on the diagnoses with or without diabetes, and then the patients with diabetes were further divided into two subgroups, good- and poor-control groups of glycaemia. Patients of type II diabetes mellitus all had a clear history of diabetes at admission, and none of them were diagnosed after admission. We defined DM patients with HbA1C level <7% included in the good-control group and ≥7% in the poor-control group. This study was strictly complied with the Treaty of Helsinki and approved by the ethics committee of the First Affiliated Hospital of Xi'an Jiaotong University. Written informed consent were waived as a retrospective research.

Data collection

All data were collected from the electronic medical records system. The general data we extracted included age, sex, symptoms and signs, underlying conditions, hepatitis status, cost and length of hospital stay. Laboratory results at admission were obtained, containing blood routine, liver function, renal function, coagulation, blood and *pus* culture data, plasma glucose and HbA1C level. Complications, treatments and outcomes were also gained. Abscess number, diameter, site and gas forming were measured by ultrasonography and computerized tomography (CT).

Follow-up

Follow-up for all patients was until June 2018 and lasted for at least 6 months after discharge. The average follow-up time was 820 (IQR: 308, 1261) days. The main contents of the follow-up included the

disease status, recurrence, and mortality of the patients. To minimize the bias, the follow-up was completed by two clinical researchers independently.

Statisticical Analysis

For continuous variables, the study was expressed as mean ± standard deviation or median (min-max) whereas categorical variables used frequency and percentage. To calculate the difference between the two groups, we applied the Student's t-test or Wilcoxon test for continuous variables and the chi-squared test or Fisher's exact test for categorical data. For three or more groups, we applied the analysis of variance. The factors that found $P<0.10$ in the univariate analysis were further estimated through the multivariate analysis. Survival curves were calculated by the Kaplan–Meier curve method, and statistical differences was calculated through Log-Rank test. All statistical analyzes were finished by SPSS 23.0 software (IBM Corporation, Armonk, NY, USA). Graphpad prism 8.0 software was used to beautified the survival curves (GraphPad Software, Inc. La Jolla, USA). $P<0.05$ was considered as statistically significant.

Results

Demographic and clinical characteristics

A total of 227 patients with PLA were enrolled in this retrospective study. As shown in Table 1, the average age of total patients was 56 years (range: 11–84 years), and 135 (59.47%) of them were male. Among them, 66 (29.07%) patients had a history of smoking, 43 (18.94%) patients had alcohol drinking history. 43 (18.94%) and 8 (3.52%) patients had hypertension and cirrhosis, respectively. Most patients had a normal (60.79%) or low-grade fever temperature (34.80%) at admission, and the medium time for temperature normalization was 6.39 (range: 0–40). leucocytes abnormally increased in 119 patients (52.42%) on the first day of admission. In this cohort, the number of abscess was mainly single (75.77%). The maximum diameter of the abscess in 132 patients (58.15%) was between 5 and 10 cm, and followed by small abscess in 75 cases (33.04%). In 137 (60.35%) patients, the abscess was located in the right liver lobe, 34 (14.98%) in the left, and 41 (18.06%) in the both. Gas formation were observed in 45 patients (19.82%). In Table 2, 114 patients (85.07%) were Gram-negative bacteria, 18 (13.43%) were Gram-positive bacteria, and 2 (1.49%) were *Candida spp.* infections. *Klebsiella pneumonia* and *Escherichia coli* in the Gram-negative organisms were the two most common bacteria in this study, accounting for 57.44% and 17.91%, respectively. In the Gram-positive organisms, *Streptococcus spp.* (6.72%) was the most pathogens cultured. It was documented that pleural and celiac effusion were the most common complications (18.41%, and 7.58%, respectively, Table 3). 136 (59.91%) patients received percutaneous drainage, 28 (12.33%) underwent surgical drainage, and the rest 63 (27.75%) were administrated conservative treatment. 125 (55.07%) patients presented combined antibiotic use. All patients showed outcomes with cured or improved and no patient died during hospital stay. The average costs of total patients was 28,700 yuan.

Associations between Diabetes Mellitus and patients characteristics

In this study, 227 patients were divided into two groups based on DM. The Non-DM group included 166 (73.13%) patients and the DM group included 61 (26.87%) patients, with an average diabetes duration time of 5.5 years (range: 0.2–30 years). There was no significant difference in gender, age, the body temperature at admission, abscess number, size, site, and gas forming between the two groups (Table 1). However, patients in DM group exhibited more hypertension but lower leucocytes counts (P<0.001, and P = 0.007, respectively). Although the infection of Gram-negative and –positive in this study were similar between the two groups, patients in DM group had higher *Candida spp.* infection than that of in Non-DM group (P = 0.049, Table 2). In Table 3, no significant difference had been found in complications, intravenous antibiotics use, outcomes, hospital stay, total costs and reoccurrence in three months between the two groups. While the choice of treatments were different between the two groups (P = 0.024). Percutaneous drainage was mainly adopted in patients without DM (64.46%), while percutaneous drainage and conservative treatment were mainly performed in patients with DM (47.54% and 40.98%).

Effect of Diabetes Mellitus on short-term survival in liver abscess patients

During the follow-up period, 24 (10.57%) died within six months and 14 (6.17%) were diagnosed with PLA recurrence within three months after discharge. The PLA patients with DM had a lower six-month survival than that of in Non-DM group (81.97% *vs.* 92.17%, P = 0.027) and no significant difference had been found with reoccurrence rate between the two groups (P = 0.164, Table 3). To explore risk factors independently associated with short-term survival after hospitalization in PLA patients, univariable and multivariable analysis were made. Univariate variables with P<0.10 were further analyzed with multivariate model. As shown in Table 4, diabetes mellitus (OR: 0.097, 95% CI: 0.018–0.526, P = 0.007) was the only independent risk factor for six-month survival after discharge. Other factors including age >60 years, gender, cirrhosis, biliary tract infection, abscess number and size, gas forming, *Escherichia coli* infection, and treatments methods were not found to be independent risk factors. The Kaplan-Meier curve of six-month survival after discharge was further estimated with regard to DM in Figure 1. It was found that PLA patients with DM had worse short-term survival than those in Non-DM group (Log-Rank test, P = 0.021).

Subgroups analysis in PLA patients with DM

Abnormal glycaemia level in the DM group was considered to be a potent risk factor of short-term survival in PLA patients, which was further investigated in subgroups. All the patients were classified into two subgroups according to the HbA1C level. The clinical characteristics, laboratory results, abscess

information, treatments and outcomes were compared between the two subgroups in Table 5. No difference was presented between the two subgroups in age, gender, diabetes duration time, underlying conditions, laboratory tests, abscess characteristics, outcomes, and hospital stay, etc. However, there was an obvious difference in the selection of treatments between the two subgroups ($P = 0.027$). Percutaneous drainage was mainly performed in patients with poor-control of glycaemia (60.53%) and conservative treatment was mainly adopted in patients with good-control of glycaemia (60.87%). Besides, combined intravenous antibiotic showed a higher proportion in poor-control group (71.05%, $P = 0.033$). Although there was no significant difference, total hospitalization costs and relapsed PLA within three months after discharge showed an obvious increase in the poor-control group compared to good-control group (42,300 *vs.* 22,100 yuan, 13.16% *vs.* 4.35%, respectively). Kaplan-Meier curve with different glycaemia levels in terms of six-month survival was shown in Figure 2. No difference was unfolded between the two groups in Kaplan-Meier plots (Log-Rank test, $P = 0.218$).

Discussion

The increasing incidence and high mortality of PLA patients with diabetes mellitus has become an important health problem in hepatobiliary system that plagues humans [6]. As a risk factor for PLA, DM can directly lead to liver damage, abnormal bile secretion, and increasing portal vein infection [8–10]. DM can also cause systemic metabolic disorders and impaired immunity, which weakens the ability of the liver to clear bacteria, making the bacteria easy to colonize and multiply to form abscesses [11]. Studies have confirmed that although the incidence of DM in PLA patients is regionally different in Asia, Europe, and America, it still can be as high as 23% to 44.9% [7, 12–14]. Even in PLA patients caused by *Klebsiella pneumonia,* the incidence of DM is higher as 49.7%. Unexpectedly, this number is likely to grow in recent years with the increasing PLA [14]. In this study, the ratio reached 26.87%.

PLA and DM are high consumption diseases and often progress rapidly when both occur. Meanwhile, the development of PLA has obvious periodicity, and the mortality rate is high during the onset period [15]. Combined with DM in PLA patients should have significant impact on overall survival, especially in the short onset period. Researchers believe that the physique of DM patients tends to be fragile, when suffered with PLA, the condition will be complicated and the mortality will be higher [16]. They discovered that PLA patients with and without DM had a mortality rate of 24.8% and 18.0% within 30 days after discharge, respectively [16]. However, other studies agreed that DM was not an independent risk factor for prognosis in PLA patients [3, 6]. In this study, six-month follow-up was performed on 227 PLA patients who were retrospectively enrolled. We found that the overall mortality rate was 10.57% within six-months after discharge, which was slightly lower than similar studies [15]. Moreover, DM existed as the only independent risk factor for six-month survival in PLA patients after hospitalization in this cohort and other high risk factors, such as age > 60 years, cirrhosis, diameter of abscess, and gas forming were not statistically significant in the multivariate model [15, 17]. Compared with 7.83% in PLA patients without DM, the mortality dramatically increased to 18.03% in patients with DM. In the further subgroups, poor-control of glycaemia didn’t reduce the short-term survival, but the recurrence rate of PLA within 3 months

after discharge showed a 3-fold increase (13.16% *vs.* 4.35%). It can be interpreted as poor-control of glycaemia inducing a higher infection and more abscess numbers by a recent similar study [7].

In PLA patients with DM, blood pressure was significant high, which suggested that these cases had vascular diseases [18]. Unexpectedly, leukocytes counts showed a higher abnormal at admission in the Non-DM group, which might be related to the heavier inflammatory status in this group. Bacterial culture revealed that *Klebsiella pneumonia* and *Escherichia coli* were still the two most common infectious pathogens, whether or not combined with DM [6, 12, 19]. Interestingly, *pus* culture results illustrated 2 cases of *Candida spp.* infection in the DM group. *Candida spp.* is rare in PLA, but it is highly related to mortality [20]. The infection rate of *candida spp.* in this study was only 0.88% (2/227), but all occurred in DM group, probably due to the vulnerable immune system in these cases. Besides, DM patients maybe more common in gas forming [21], but slightly higher rate has been found in this study (24.59% *vs.* 18.07%).

The administration of PLA with DM is commonly more complex than simple PLA. Hyperglycemia in tissue easily causes cell hyperosmosis, regeneration and repair function weakening, which then may delay puncture heling [22]. In our study, PLA patients without DM were mainly operated with percutaneous drainage, while in DM group, percutaneous drainage and simple conservative management were mainly used. Interestingly, in the further subgroups, patients with poor blood glycemic control were mainly performed with percutaneous drainage, while patients with good control were mostly treated with conservative method. It seems that the diameter of abscesses in poor-controlled group is generally larger in this study [23]. In the poor-control of glycaemia group, PLA patients with maximum diameter of abscess ≥5 cm accounted for 65.79%, while those in good-control group were only 52.17% [24]. It was notable that the poor-controlled group had a higher proportion of combined antibiotic administration and the good-controlled group presented with single antibiotic [7]. In addition, the hospitalization cost in poor-controlled group was twice that of the good-controlled group, although there was no significant difference in hospital stay between the two groups [25]. Previous studies have shown that gas forming nature and higher creatinine are risk predictors of fatality for PLA patients [6]. However, in our multivariate model, they were not illustrated to be independent risk factors affecting six-month survival after hospitalization.

The limitations of this study are mainly focused on its retrospective and single-centered traits, while because of its large sample size, the conclusions we have gained can still be used as helpful reference for other researchers and clinicians, especially further enriching the experience of diagnosis and treatment of PLA patients with DM in northwestern China. Moreover, as the follow-up time in the present study was only six months, further longer follow-up and expanded sample size will be needed to comment on the long-term administrations and outcomes of PLA patients with DM.

Conclusion

Underlying with DM is common in PLA patients, whose epidemiology and administrations shows unique specificities. PLA patients with DM have higher incidence of hypertension and *Candida spp.* infection. In

the DM group, patients were mainly treated with conservative method and more combined antibiotics use. During the follow-up period, DM group showed a higher mortality rate than that in the Non-DM group. It was found that DM aggravated six-month mortality after hospitalization and presented to be the only independent risk factor for the short-term survival in PLA patients. Moreover, poor-control of glycaemia level might cause different treatments and relapse PLA more frequently. Hence, DM is an important risk factor for PLA patients and effective management of blood glucose levels should be recommended.

Declarations

List of abbreviations: PLA: Pyogenic liver abscess; WBC: white blood cell; ALT: alanine aminotransferase; AST: aspartate aminotransferase; TBIL: total bilirubin; ALB: Albumin; PT: prothrombin time; APTT: activated partial thromboplatin time; BUN: blood urea nitrogen; Cr: creatinine; DM: diabetes mellitus; Non-DM: non-diabetes mellitus.

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Ethics approval and consent to participate: This study was approved by the Ethics Committee of the First Affiliated Hospital of Xi'an Jiaotong University (XJTU1AF2015LSL–057). Written informed consent were waived as a retrospective research. There was not further permission from the hospital.

Consent for publication: Not applicable.

Competing interests: The authors declare no competing financial interests.

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Tables

Table 1. Clinical characteristics of the 227 patients with pyogenic liver abscess patients with diabetes or without diabetes presented at admission.

Values	Median (range)/*n* (percentage)	Diabetes Mellitus	Non-Diabetes Mellitus	*p* value
n	227	61 (26.87%)	166 (73.13%)	
Age (years)	56 (11-84)	57 (22-84)	56 (11-84)	0.837
Gender (male)	135 (59.47%)	39 (63.93%)	96 (57.83%)	0.406
Underlying conditions				
Smoking	66 (29.07%)	16 (26.23%)	50 (30.12%)	0.567
Drinking	43 (18.94%)	33 (19.88%)	10 (16.39%)	0.552
Hypertension	43 (18.94%)	31 (50.82%)	12 (7.23%)	**<0.001**
Cirrhosis	8 (3.52%)	2 (3.28%)	6 (3.61%)	0.902
Body temperature at admission (°C)				
35.5°C~37.3 °C	138 (60.79%)	42 (68.85%)	96 (57.83%)	0.319
37.4 °C~39 °C	79 (34.80%)	17 (27.87%)	62 (37.35%)	
>39.1 °C	10 (4.41%)	2 (3.28%)	8 (4.82%)	
Time for temperature normalization (days)	6.39 (0-40)	6.05 (0-24)	6.51 (0-40)	0.593
Laboratory tests				
WBC > 10×10^9/L	119 (52.42%)	23 (37.70%)	96 (57.83%)	**0.007**
WBC < 3.5×10^9/L	4 (1.76%)	3 (4.92%)	1 (0.60%)	0.105
ALT > 40 U/L	108 (47.58%)	25 (40.98%)	83 (50.00%)	0.228
AST > 40 U/L	67 (29.52%)	15 (24.59%)	52 (31.33%)	0.324
ALB < 35 g/L	169 (74.45%)	45 (73.77%)	124 (74.70%)	0.887
TBIL > 17 μmol/L	96 (42.29%)	31 (50.82%)	65 (39.16%)	0.115
PT > 17 s	20 (8.81%)	6 (9.84%)	14 (8.43%)	0.741
APTT > 45 s	26 (11.45%)	7 (11.48%)	19 (11.45%)	0.995
BUN > 7.2 mmol/L	16 (7.27%)	7 (11.67%)	9 (5.63%)	0.213
Cr > 97 μmol/L	30 (13.64%)	7 (11.67%)	23 (14.37%)	0.602
Abscess number				
Solitary abscess	172 (75.77%)	47 (77.05%)	125 (75.30%)	0.785
Multiple abscess	55 (24.23%)	14 (22.95%)	41 (24.70%)	
Maximal diameter of abscess				
≤ 5 cm	75 (33.04%)	24 (39.34%)	51 (30.72%)	0.116
5~10 cm	132 (58.15%)	34 (55.74%)	98 (59.04%)	
> 10 cm	20 (8.81%)	3 (4.92%)	17 (10.24%)	
Abscess site				
Left lobe	34 (14.98%)	6 (9.84%)	28 (16.87%)	0.289
Right lobe	137 (60.35%)	43 (70.49%)	94 (56.63%)	
Both left and right	41 (18.06%)	9 (14.75%)	32 (19.28%)	
Other sites	15 (6.61%)	3 (4.92%)	12 (7.23%)	
Gas forming	45 (19.82%)	15 (24.59%)	30 (18.07%)	0.275

WBC: white blood cell; ALT: alanine transaminase; AST: aspartate transaminase; ALB: albumin; TBIL: total bilirubin; PT, prothrombin time; APTT, activated partial thromboplastin time; BUN: blood urea nitrogen; Cr: creatinine.

Table 2. Blood and *pus* cultures in pyogenic liver abscess patients with diabetes mellitus (DM) and non-diabetes mellitus (Non-DM).

Values	Blood culture			*Pus* culture		
	DM (n = 43)	Non-DM (n = 136)	*P* value	DM (n = 42)	Non-DM (n = 145)	*P* value
Positive results	35	118	0.384	19	71	0.670
Polymicrobial results	2	5	1.000	3	2	0.135
Gram-negative organisms						
Klebsiella pneumonia	3	12	0.948	15	47	0.689
Escherichia coli	4	3	0.101	5	12	0.678
Pseudomonas aeruginosa	1	0	0.240	2	1	0.127
Enterobacter cloacae	0	0	–	0	2	1.000
Proteus spp.	0	0	–	0	2	1.000
Serratia fonticola	0	1	1.000	0	0	–
Salmonella enteritidis	0	0	–	1	0	0.223
Klebsiella oxytoca	0	0	–	0	1	1.000
Bacillus citrate	0	0	–	0	1	1.000
Stenotrophomonas maltophilia	0	0	–	1	0	0.225
Gram-positive organisms						
Streptococcus spp.	1	1	0.424	0	7	0.322
Enterococcus spp.	2	0	0.057	0	3	1.000
Clostridium spp.	0	2	1.000	0	0	–
Staphylococcus spp.	0	1	1.000	0	1	1.000
Candida spp.	0	0	–	2	0	**0.049**

Table 3. Complications, treatments, outcomes and survival of the pyogenic liver abscess patients with diabetes mellitus and non-diabetes mellitus.

Variables	Median (range)/*n* (percentage)	Diabetes Mellitus	Non-Diabetes Mellitus	*p* value
Complications				
Bile leakage	9 (3.96%)	2 (3.28%)	7 (4.22%)	1.000
Intraperitoneal bleeding	10 (4.41%)	3 (4.92%)	7 (4.22%)	0.731
Plumonary infection	5 (2.20%)	2 (3.28%)	3 (1.81%)	0.613
Pleural effusion	51 (18.41)	17 (27.87%)	34 (20.48%)	0.237
Celiac effusion	21 (7.58)	8 (13.11%)	13 (7.83%)	0.208
Treatments				
Percutaneous drainage	136 (59.91%)	29 (47.54%)	107 (64.46%)	**0.024**
Surgical drainage	28 (12.33%)	7 (11.48%)	21 (12.65%)	
Conservative treatment	63 (27.75%)	25 (40.98%)	38 (22.89%)	
Antibiotic use				
Combined	125 (55.07%)	37 (60.66%)	88 (53.01%)	0.305
Single	102 (44.93%)	24 (39.34%)	78 (46.99%)	
Outcomes				
Cured	155 (68.28%)	45 (73.77%)	110 (66.27%)	0.282
Improved	72 (31.72%)	16 (26.23%)	56 (33.73%)	
Death	0 (0%)	0 (0%)	0 (0%)	
Hospital stay (days)	14 (2-52)	15 (3-40)	14 (2-52)	0.444
Total Hospitalization expenses (× 10000 yuan)	2.87 (0.27-19.03)	2.97 (0.27-19.03)	2.84 (0.33-12.65)	0.748
Reoccurrence in three months	14 (6.17%)	6 (9.84%)	8 (21.05%)	0.164
Survival (yes/no) in six months	203 (89.43%)	50 (81.97%)	153 (92.17%)	**0.027**

Table 4. Univariate and multivariate analysis of factors associated with PLA six-month survival.

Variables	Univariate analysis		Multivariate analysis	
	P	OR (95%CI)	*P*	OR (95%CI)
Age > 60 years	0.284	2.261 (0.517-9.507)		
Gender (male)	0.212	0.395 (0.092-1.627)		
Smoking (yes/no)	0.595	1.486 (0.345-6.404)		
Drinking (yes/no)	0.658	1.447 (0.282-7.430)		
Hypertension (yes/no)	0.658	1.447 (0.282-7.430)		
Cirrhosis (yes/no)	0.197	4.327 (0.467-40.094)		
Diabetes (yes/no)	**0.008**	8.945 (1.754-45.619)	**0.007**	0.097 (0.018-0.526)
Biliary tract infection (yes/no)	0.868	0.835 (0.099-7.015)		
Leucocytes > 10 $\times 10^9$/L	0.397	0.533 (0.124-2.284)		
Hemoglobin < 120 g/L	0.451	0.536 (0.106-2.716)		
Platelet count < 100 $\times 10^9$/L	0.891	1.161 (0.137-9.843)		
TBIL > 17 μmol/L	0.252	2.344 (0.546-10.058)		
PT > 17 s	0.150	3.722 (0.700-19.800)		
BUN > 7.2 mmol/L	0.351	2.19 (0.421-11.394)		
Cr > 97 μmol/L	0.568	1.876 (0.216-16.27)		
Abscess number	0.373	0.382 (0.046-3.175)		
Diameter of abscess	0.960	1.029 (0.337-3.141)		
Abscess site	0.093	1.822 (0.905-3.667)	0.114	2.156(0.832-5.586)
Gas forming	0.159	5.024 (0.531-47.518)		
Klebsiella pneumonia infection	0.297	0.315 (0.036-2.758)		
Escherichia coli infection	0.083	2.194 (0.904-5.325)	0.101	0.226(0.038-1.339)
Treatments	0.940	1.046 (0.327-3.344)		

TBIL: total bilirubin; PT, prothrombin time; BUN: blood urea nitrogen; Cr: creatinine.

Table 5. The clinical characteristics of pyogenic liver abscess with DM between poor-control of glycaemia group and good-control of glycaemia group.

Variables	good-control of Glycaemia (n=23)	poor-control of Glycaemia (n=38)	*p* value
Age (years)	57 (22-84)	58 (23-80)	0.951
Gender (male)	15 (65.22%)	24 (63.16%)	0.871
Diabetes duration (years)	5.4 (0.4-27)	5.5 (0.2-30)	0.952
Underlying condition			
Smoking	8 (34.78%)	8 (21.05%)	0.237
Drinking	5 (21.74%)	5 (13.16%)	0.603
Hypertension	6 (27.27%)	6 (15.79%)	0.461
Laboratory tests			
WBC > 10×10^9/L	7 (30.43%)	16 (42.11%)	0.362
WBC < 3.5×10^9/L	2 (8.70%)	1 (2.63%)	0.652
ALT > 40 U/L	12 (52.17%)	13 (34.21%)	0.167
AST > 40 U/L	7 (30.43%)	8 (21.05%)	0.410
ALB < 35 g/L	16 (69.57%)	29 (76.32%)	0.561
TBIL > 17 μmol/L	14 (60.87%)	17 (44.74%)	0.222
PT > 17 s	4 (17.39%)	2 (5.26%)	0.272
APTT > 45 s	3 (13.04%)	4 (10.53%)	1.000
BUN > 7.2 mmol/L	2 (8.70%)	5 (13.51%)	0.697
Cr > 97 μmol/L	2 (8.70%)	5 (13.51%)	0.697
Abscess number			
Solitary abscess	18 (78.26%)	29 (76.32%)	0.861
Multiple abscess	5 (21.74%)	9 (23.68%)	
Maximal diameter of abscess			
≤ 5 cm	11 (47.83%)	13 (34.21%)	0.178
5~10 cm	11 (47.83%)	23 (60.53%)	
> 10 cm	1 (4.35%)	2 (5.26%)	
Abscess site			
Left lobe	4 (17.39%)	2 (5.36%)	0.220
Right lobe	13 (56.52%)	30 (78.95%)	
Both left and right	5 (21.74%)	4 (10.53%)	
Other sites	1 (4.35%)	2 (5.26%)	
Klebsiella pneumonia infection	4 (17.39%)	11 (28.95%)	0.310
Escherichia coli infection	2 (8.70%)	3 (7.89%)	1.000
Treatments			
Percutaneous drainage	6 (26.09%)	23 (60.53%)	**0.027**
Surgical drainage	3 (13.04%)	4 (10.53%)	
Conservative treatment	14 (60.87%)	11 (28.95%)	
Antibiotic use			
Combined	10 (43.48%)	27 (71.05%)	**0.033**
Single	13 (56.52%)	11 (28.95%)	
Outcomes			
Cured	16 (69.57%)	29 (76.34%)	0.565
Improved	7 (30.43%)	9 (23.68%)	
Death	0 (0%)	0 (0%)	
Hospital stay (days)	15 (3-40)	15 (3-28)	0.986
Total Hospitalization expenses (× 10000 yuan)	2.21 (0.17-5.46)	4.23 (0.43-19.03)	0.056
Reoccurrence in three months	1 (4.35%)	5(13.16%)	0.395
Survival (yes/no) in six months	17 (73.91%)	33 (86.84%)	0.353

WBC: white blood cell; ALT: alanine transaminase; AST: aspartate transaminase; ALB: albumin; TBIL: total bilirubin; PT, prothrombin time; APTT, activated partial thromboplastin time; BUN: blood urea nitrogen; Cr: creatinine.

Figures

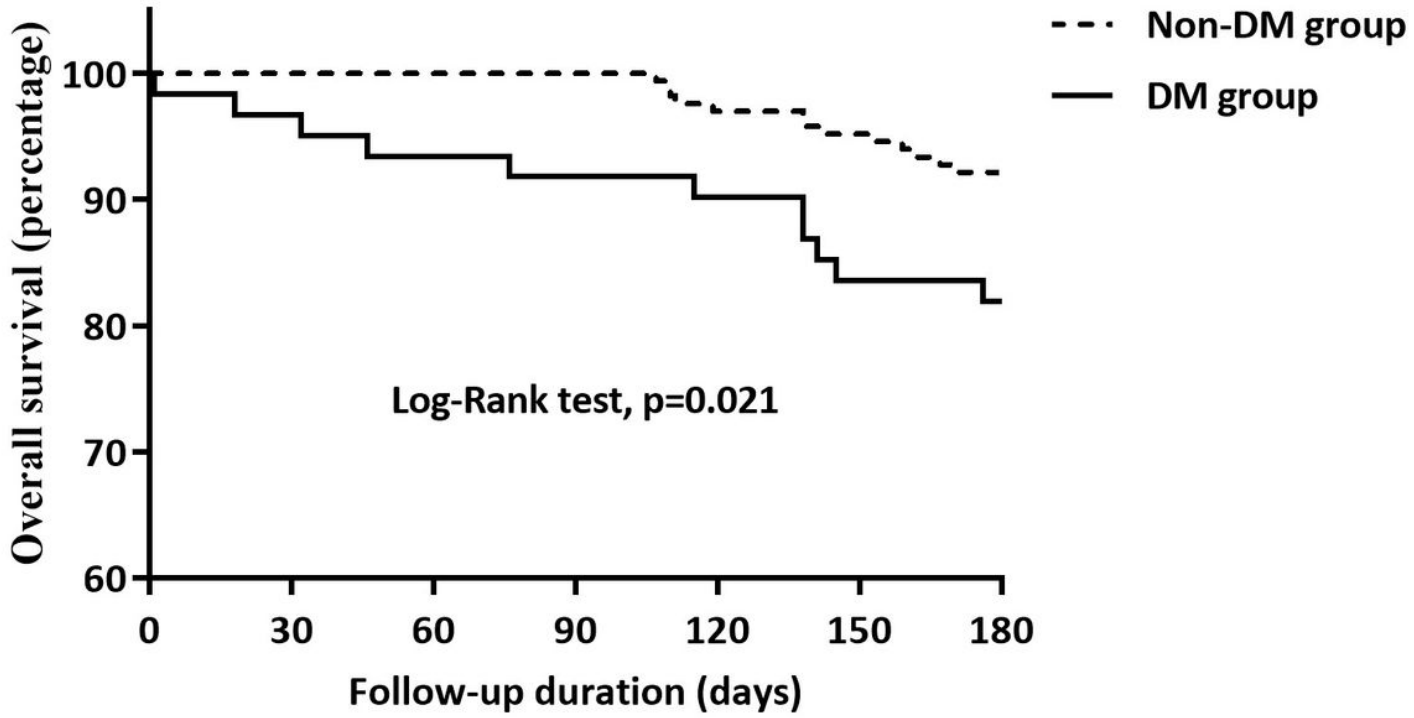

Figure 1

Effect of diabetes mellitus on six-month survival in PLA patients after discharge. Differences in short-term survival rates between PLA patients who combined with diabetes (DM group) and those who did not combined with diabetes (Non-DM group). The survival rate was assessed by the Kaplan-Meier analysis and compared by the Log-Rank test.

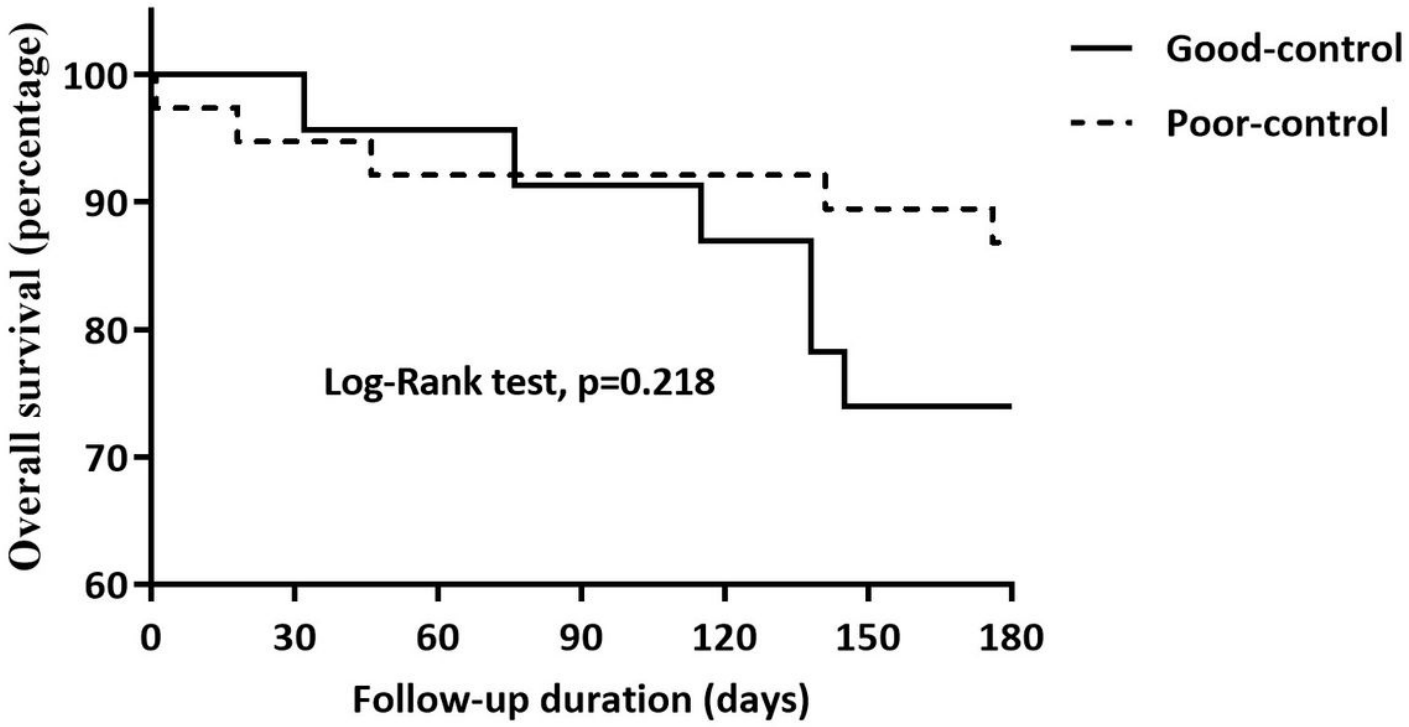

Figure 2

Effect of controlled blood glycaemia level on six-month survival in PLA patients with diabetes after discharge. Differences in short-term survival rates between PLA patients with diabetes who performed with good-control of glycaemia (Good-control group) and those who did not (Poor-control group). The survival rate was assessed by the Kaplan-Meier analysis and compared by the Log-Rank test.