·临床研究·

# 老年糖尿病患者微血管并发症的患病率及危险因素

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**【摘 要】 目的** 探讨老年糖尿病患者微血管并发症的患病率,并分析发生微血管病变的危险因素。**方法** 回顾性分析北京协和医院2020年1月至2022年12月收治的495例老年糖尿病患者的临床资料,收集患者基线资料和生化指标,统计糖尿病视网膜病变、糖尿病肾病、周围神经病变等微血管并发症的患病率。根据微血管并发症的类型将患者分为4组:糖尿病视网膜病变组($n$=107)、糖尿病肾病组($n$=81)、周围神经病变组($n$=169)及非并发症组($n$=138)。采用SPSS 22.0统计软件进行数据分析。根据数据类型,分别采用方差分析或$\chi^2$检验进行组间比较。采用多因素logistic回归分析糖尿病微血管病变发生的危险因素。**结果** 495例老年糖尿病患者中共357例发生微血管并发症,总患病率为72.12%,其中糖尿病视网膜病变占21.62%(107/495),糖尿病肾病占16.36%(81/495),周围神经病变占34.14%(169/495)。与非并发症组患者比较,糖尿病视网膜病变组患者糖尿病病程更长,收缩压(SBP)和糖化血红蛋白(HbA1c)水平更高,低密度脂蛋白胆固醇(LDL-C)水平较低;糖尿病肾病组患者糖尿病病程更长,甘油三酯(TG)和24 h尿白蛋白排泄率(UAER)更高;周围神经病变组患者SBP、舒张压(DBP)、HbA1c、总胆固醇(TC)和TG更高,差异均有统计学意义($P$<0.05)。多因素logistic回归分析结果显示,糖尿病病程长($OR$=3.013,95%$CI$ 1.206~7.526;$P$=0.019)、高SBP($OR$=2.445,95%$CI$ 1.105~5.408;$P$=0.028)和高HbA1c($OR$=3.093,95%$CI$ 1.112~8.606;$P$=0.031)是并发糖尿病视网膜病变的独立危险因素;糖尿病病程长($OR$=2.404,95%$CI$ 1.185~4.877;$P$=0.016)、高TG($OR$=2.654,95%$CI$ 1.241~5.677;$P$=0.012)和高UAER($OR$=3.432,95%$CI$ 1.303~9.036;$P$=0.013)是并发糖尿病肾病的独立危险因素;高SBP($OR$=2.020,95%$CI$ 1.228~3.323;$P$=0.006)、高DBP($OR$=2.560,95%$CI$ 1.109~5.912;$P$=0.028)、高HbA1c($OR$=2.382,95%$CI$ 1.321~4.297;$P$=0.004)、高TC($OR$=2.779,95%$CI$ 1.057~7.303;$P$=0.039)和高TG($OR$=2.266,95%$CI$ 1.237~4.152;$P$=0.008)是并发周围神经病变的独立危险因素。**结论** 老年糖尿病患者微血管并发症的患病率较高,糖尿病病程长及SBP、DBP、HbA1c、TC、TG、UAER高是微血管并发症的危险因素,临床需重视。

**【关键词】** 老年人;糖尿病;微血管并发症;患病率;危险因素
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# Prevalence of microvascular complications in elderly patients with diabetes mellitus and related risk factors

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**【Abstract】 Objective** To investigate the prevalence of microvascular complications in elderly patients with diabetes mellitus, and analyze the risk factors of microvascular diseases. **Methods** A retrospective analysis was conducted on the clinical data of 495 elderly diabetic patients admitted to Peking Union Medical College Hospital from January 2020 to December 2022. Their baseline information and biochemical indicators were collected, and the incidences of microvascular complications such as diabetic retinopathy, diabetic nephropathy and peripheral neuropathy were recorded. According to the type of microvascular complications, the patients were divided into diabetic retinopathy group ($n$=107), diabetic nephropathy group ($n$=81), peripheral neuropathy group ($n$=169) and non-complication group ($n$=138). SPSS statistics 22.0 was used for data analysis. Based on different data type, one-way ANOVA or *Chi*-squared test was employed for intergroup comparison. Multivariate logistic regression analysis was applied to determine the related risk factors leading to diabetes microvascular disease. **Results** Among the 495 elderly patients with diabetes mellitus, 357 had microvascular complications, with a total prevalence rate of 72.12%, including 21.62% (107/495) of diabetes retinopathy, 16.36% (81/495) of diabetes nephropathy, and 34.14% (169/495) of peripheral neuropathy. Compared with the patients of the non-complication group, those of the diabetic retinopathy group had a longer course of diabetes mellitus, higher systolic blood pressure (SBP) and glycosylated hemoglobin

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A1c (HbA1c), and lower low-density lipoprotein cholesterol (LDL-C) level; those of the diabetic nephropathy group had longer course of diabetes mellitus and higher TG and 24-hour urine albumin excretion rate (UAER); and those with peripheral neuropathy had higher levels of SBP, diastolic blood pressure (DBP), HbA1c, total cholesterol (TC) and triglyceride (TG) (all $P<0.05$). Multivariate logistic regression analysis showed that the long duration of diabetes mellitus ($OR=3.013$, 95%$CI$ 1.206-7.526; $P=0.019$), high SBP ($OR=2.445$, 95%$CI$ 1.105-5.408; $P=0.028$) and high HbA1c ($OR=3.093$, 95%$CI$ 1.112-8.606; $P=0.031$) were independent risk factors for diabetic retinopathy. Long duration of diabetes mellitus ($OR=2.404$, 95%$CI$ 1.185-4.877; $P=0.016$), high TG ($OR=2.654$, 95%$CI$ 1.241-5.677; $P=0.012$) and high UAER ($OR=3.432$, 95%$CI$ 1.303-9.036; $P=0.013$) were independent risk factors for diabetic nephropathy. High SBP ($OR=2.020$, 95%$CI$ 1.228-3.323; $P=0.006$), high DBP ($OR=2.560$, 95%$CI$ 1.109-5.912; $P=0.028$), high HbA1c ($OR=2.382$, 95%$CI$ 1.321-4.297; $P=0.004$), high TC ($OR=2.779$, 95%$CI$ 1.057-7.303; $P=0.039$) and high TG ($OR=2.266$, 95%$CI$ 1.237-4.152; $P=0.008$) were independent risk factors for peripheral neuropathy. **Conclusion** Elderly diabetes patients have a higher prevalence of microvascular complications. Long duration of diabetes mellitus, high SBP, DBP, HbA1c, TC, TG and UAER are risk factors for the aforementioned complications, and attention should be paid to these factors.

**【Key words】** aged; diabetes mellitus; microvascular complications; prevalence; risk factors

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糖尿病是多发于老年人群的常见慢性代谢性疾病,病理基础在于胰岛素分泌不足和(或)胰岛素作用缺陷引起的慢性血糖升高,常见的有 1 型糖尿病和 2 型糖尿病两种,以 2 型居多,占 95%以上[1]。老年 2 型糖尿病患者机体长期处于高糖水平,易引起微血管病变、周围神经病变和动脉粥样硬化等异常病变,进而出现糖尿病足、糖尿病肾病及糖尿病视网膜病变等一系列并发症[2],不但对老年患者的正常生活和社交产生极大影响,也逐渐成为老年人糖尿病患者致残和致死的重要原因之一[3]。因此,临床需格外重视老年糖尿病患者并发症的预防和早期发现,以改善老年患者的生存情况。既往多项研究均指出,老年糖尿病患者微血管病变的发病原因与多种因素相关[4,5]。本研究探讨老年患者微血管并发症的患病率及患病的高危风险因素,希望为老年糖尿病患者微血管病变的防治提供更多有效的数据支撑。

## 1 对象与方法

### 1.1 研究对象

回顾性分析北京协和医院 2020 年 1 月至 2022 年 12 月收治的老年糖尿病患者的临床资料。纳入标准:(1)符合世界卫生组织糖尿病诊断标准[6];(2)诊断为 2 型糖尿病;(3)≥60 周岁;(4)均为单一微血管并发症。排除标准:(1)合并恶性肿瘤;(2)合并急性感染性疾病;(3)原发性肾脏病变或肝肾功能异常;(4)确诊糖尿病前已有微血管病变疾病;(5)临床资料缺失。符合标准者共 495 例,男性 239 例,女性 256 例;年龄 61~89(76.26±4.89)岁;病程 0.6~19(11.33±3.08)年。根据微血管并发症的类型将患者分为 4 组:糖尿病视网膜病变组($n=107$)、糖尿病肾病组($n=81$)、周围神经病变组($n=169$)及非并发症组($n=138$)。

糖尿病微血管并发症诊断标准:所有患者均接受了眼底检查、肝肾指标实验室检查和神经传导速度等相关检查,符合糖尿病视网膜病变、糖尿病肾病、周围神经病变相关诊断标准[7],眼底检查结果确认为糖尿病视网膜病变,实验室检查确认为糖尿病肾病,神经传导速度异常可确认为周围神经病变。

### 1.2 方法

1.2.1 基线资料采集 收集 495 例老年糖尿病患者基线资料,包括性别、年龄、糖尿病病程、高血压史、吸烟史、饮酒史、体质量指数(body mass index, BMI)、收缩压(systolic blood pressure, SBP)及舒张压(diastolic blood pressure, DBP)。

1.2.2 生化指标采集 收集所有患者晨起空腹肘静脉血各 5 ml,以进行实验室生化指标检测。采用全自动生化分析仪测定空腹血糖(fasting blood glucose, FBG)、总胆固醇(total cholesterol, TC)、甘油三酯(triglyceride, TG)、高密度脂蛋白胆固醇(high-density lipoprotein cholesterol, HDL-C)和低密度脂蛋白胆固醇(low-density lipoprotein cholesterol, LDL-C)水平。采用化学发光法[8]测定空腹胰岛素(fasting insulin, FINS)水平。采用高效液相色谱法[9]测定糖化血红蛋白(glycosylated hemoglobin A1c, HbA1c)水平。采用全自动化学发光免疫分析仪测定 24 h 尿白蛋白排泄率(urine albumin excretion rate, UAER)。

### 1.3 统计学处理

采用 SPSS 22.0 统计软件进行数据分析。计量资料以均数±标准差($\bar{x}\pm s$)表示,多组间比较采用方

差分析,组内两两比较采用SNK-$q$检验。计数资料以例数(百分率)表示,组间比较采用$\chi^2$检验。采用多因素logistic回归分析导致糖尿病微血管病变的危险因素。$P<0.05$为差异有统计学意义。

## 2 结 果

### 2.1 老年糖尿病患者微血管并发症情况

495例老年糖尿病患者中357例发生微血管并发症,占72.12%,其中糖尿病视网膜病变占21.62%(107/495);糖尿病肾病占16.36%(81/495);周围神经病变占34.14%(169/495)。

### 2.2 4组患者临床资料比较

与非并发症组患者比较,视网膜病变组患者糖尿病病程更长,SBP和HbA1c更高,LDL-C水平较低;糖尿病肾病组患者糖尿病病程更长,TG和UAER更高;周围神经病变组患者SBP、DBP、HbA1c、TC和TG均更高,差异均有统计学意义($P<0.05$)。此外,与糖尿病视网膜病变组比较,糖尿病肾病组、周围神经病变组及非并发症组患者抽烟比例更高,差异有统计学意义($P<0.05$;表1)。

### 2.3 多因素logistic回归分析患者并发糖尿病视网膜病变的危险因素

以是否并发糖尿病视网膜病变为因变量,将单因素分析中差异有统计学意义的指标设为自变量,进行多因素logistic回归分析,结果显示糖尿病病程、高SBP和HbA1c是并发糖尿病视网膜病变的独立危险因素($P<0.05$;表2)。

### 2.4 多因素logistic回归分析老年糖尿病并发糖尿病肾病危险因素

以是否并发糖尿病肾病为因变量,将单因素分析中差异有统计学意义的指标设为自变量,进行多因素logistic回归分析,结果显示糖尿病病程、高TG和UAER是并发糖尿病肾病的独立危险因素($P<0.05$;表3)。

### 2.5 多因素logistic回归分析老年糖尿病并发周围神经病变危险因素

以是否并发糖尿病周围神经病变为因变量,将单因素分析中差异有统计学意义的指标设为自变量,进行多因素logistic回归分析,结果显示高SBP、DBP、HbA1c、TC和TG是并发周围神经病变相的独立危险因素($P<0.05$;表4)。

**表1 4组患者临床资料比较**

Table 1 Comparison of clinical data among four groups

| Item | Diabetic retinopathy group($n$=107) | Diabetic nephropathy group($n$=81) | Peripheral neuropathy group($n$=169) | Non-complication group($n$=138) | $\chi^2/F$ | $P$ value |
|---|---|---|---|---|---|---|
| Gender[$n$(%)] | | | | | 1.616 | 0.656 |
| Male | 52(48.60) | 39(48.15) | 87(51.48) | 61(44.20) | | |
| Female | 55(51.40) | 42(51.85) | 82(48.52) | 77(55.80) | | |
| Age(years, $\bar{x}\pm s$) | 76.58±5.03 | 75.97±5.23 | 76.02±4.97 | 76.47±4.89 | 0.447 | 0.720 |
| Course of diabetes mellitus(years, $\bar{x}\pm s$) | 12.46±2.75 | 13.01±1.93 | 10.55±2.84*# | 10.41±3.08*# | 30.188 | <0.001 |
| Hypertension[$n$(%)] | 45(42.06) | 39(48.15) | 72(42.60) | 63(45.65) | 1.003 | 0.800 |
| Smoking[$n$(%)] | 42(49.53) | 46(56.79)* | 91(53.85)* | 79(57.25)* | 9.462 | 0.024 |
| Alcohol drinking[$n$(%)] | 36(33.64) | 32(39.51) | 70(41.42) | 55(39.86) | 1.757 | 0.624 |
| BMI(kg/m$^2$, $\bar{x}\pm s$) | 24.16±1.55 | 24.20±1.49 | 24.05±1.78 | 24.13±1.26 | 0.212 | 0.888 |
| SBP(mmHg, $\bar{x}\pm s$) | 146.33±13.70 | 132.05±11.96* | 143.12±13.88# | 130.26±12.75*△ | 194.501 | <0.001 |
| DBP(mmHg, $\bar{x}\pm s$) | 86.96±8.11 | 87.14±7.09 | 93.49±7.12*# | 87.03±6.95△ | 266.795 | <0.001 |
| FBG(mmol/L, $\bar{x}\pm s$) | 8.71±0.64 | 8.78±0.77 | 8.69±0.83 | 8.75±0.70 | 0.336 | 0.799 |
| HbA1c(%, $\bar{x}\pm s$) | 8.86±0.19 | 7.60±0.19* | 8.73±0.21*# | 7.58±0.12*△ | 388.255 | <0.001 |
| FINS(IU/L, $\bar{x}\pm s$) | 12.17±1.56 | 12.18±1.43 | 12.13±1.55 | 12.15±1.63 | 0.025 | 0.995 |
| TC(mmol/L, $\bar{x}\pm s$) | 4.21±0.25 | 4.27±0.30 | 5.14±0.33*# | 4.25±0.28△ | 621.232 | <0.001 |
| TG(mmol/L, $\bar{x}\pm s$) | 1.73±0.13 | 2.38±0.22* | 2.32±0.26* | 1.71±0.11#△ | 355.901 | <0.001 |
| HDL-C(mmol/L, $\bar{x}\pm s$) | 1.15±0.20 | 1.12±0.25 | 1.13±0.24 | 1.14±0.29 | 0.268 | 0.848 |
| LDL-C(mmol/L, $\bar{x}\pm s$) | 2.99±0.29 | 3.04±0.31 | 3.03±0.35 | 3.06±0.23* | 1.115 | 0.343 |
| UAER(μg/24 h, $\bar{x}\pm s$) | 281.07±30.41 | 386.58±36.42* | 290.15±29.47*# | 288.13±31.35# | 217.637 | <0.001 |

BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure; FBG: fasting blood glucose; HbA1c: glycosylated hemoglobin A1c; FINS: fasting serum insulin; TC: total cholesterol; TG: triglyceride; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; UAER: urine albumin excretion rate. 1 mmHg=0.133 kPa. Compared with diabetic retinopathy group, *$P<0.05$; compared with diabetic nephropathy group, #$P<0.05$; compared with peripheral neuropathy group, △$P<0.05$.

**表 2 多因素 logistic 回归分析患者并发糖尿病视网膜病变的危险因素**

Table 2 Multivariate logistic regression analysis of risk factors for diabetic retinopathy

| Factor | $\beta$ | *SE* | *Wald* $\chi^2$ | *OR* | 95%*CI* | *P* value |
|---|---|---|---|---|---|---|
| Course of diabetes mellitus | 1.103 | 0.467 | 5.578 | 3.013 | 1.206-7.526 | 0.019 |
| SBP | 0.894 | 0.405 | 4.873 | 2.445 | 1.105-5.408 | 0.028 |
| HbA1c | 1.129 | 0.522 | 4.678 | 3.093 | 1.112-8.606 | 0.031 |

SBP: systolic blood pressure; HbA1c: glycosylated hemoglobin A1c.

**表 3 多因素 logistic 回归分析患者并发糖尿病肾病的危险因素**

Table 3 Multivariate logistic regression analysis of risk factors for diabetic nephropathy

| Factor | $\beta$ | *SE* | *Wald* $\chi^2$ | OR | 95%*CI* | *P* value |
|---|---|---|---|---|---|---|
| Course of diabetes mellitus | 0.877 | 0.361 | 5.902 | 2.404 | 1.185-4.877 | 0.016 |
| TG | 0.976 | 0.388 | 6.328 | 2.654 | 1.241-5.677 | 0.012 |
| UAER | 1.233 | 0.494 | 6.230 | 3.432 | 1.303-9.036 | 0.013 |

TG: triglyceride; UAER: urine albumin excretion rate.

**表 4 多因素 logistic 回归分析患者并发周围神经病变的危险因素**

Table 4 Multivariate logistic regression analysis of risk factors for peripheral neuropathy

| Factor | $\beta$ | *SE* | *Wald* $\chi^2$ | *OR* | 95%*CI* | *P* value |
|---|---|---|---|---|---|---|
| SBP | 0.703 | 0.254 | 7.660 | 2.020 | 1.228-3.323 | 0.006 |
| DBP | 0.940 | 0.428 | 4.846 | 2.560 | 1.109-5.912 | 0.028 |
| HbA1c | 0.868 | 0.301 | 8.316 | 2.382 | 1.321-4.297 | 0.004 |
| TC | 1.022 | 0.493 | 4.297 | 2.779 | 1.057-7.303 | 0.039 |
| TG | 0.818 | 0.309 | 7.008 | 2.266 | 1.237-4.152 | 0.008 |

SBP: systolic blood pressure; DBP: diastolic blood pressure; HbA1c: glycosylated hemoglobin A1c; TC: total cholesterol; TG: triglyceride.

## 3 讨 论

老年糖尿病典型特征是慢性高血糖和进行性血管病变,糖尿病并发症是威胁老年糖尿病患者生命健康的重要因素之一,临床上将血管并发症分为大血管并发症和微血管并发症两类,其中以微血管并发症多见,也是导致老年患者残疾和死亡的主要原因[10]。为了降低老年糖尿病患者微血管病变的患病率,本研究从导致微血管并发症的危险因素出发,旨在为老年糖尿病患者微血管并发症的临床防治提供更多思路。

本研究对 495 例老年糖尿病患者进行调查,发现微血管病变的患病率高达 72.12%,糖尿病视网膜病变占 21.62%,糖尿病肾病占 16.36%,周围神经病变占 34.14%。与既往研究报道相比仍处于较高水平[11,12],这与以下两个方面因素有关:(1)老年人群有固定的生活、饮食和运动习惯,患有糖尿病的老年人一般自身习惯较差,使其并发糖尿病视网膜病变、糖尿病肾病和周围神经病变等微血管病变的概率大大提升[13];(2)本研究选择的人群均为主动来院就诊的老年糖尿病患者,这些患者中部分或已出现并发症相关症状才来接受医学治疗,这些因素使入组病例中整体微血管并发症的患病率相对较高[14]。

为进一步探讨老年糖尿病并发微血管病变的相关因素,本研究收集了老年患者的临床资料和实验室化验指标,结果显示,不同的微血管并发症发病的危险因素不尽相同,糖尿病病程久、高 SBP 和 HbA1c 是并发糖尿病视网膜病变的独立危险因素;糖尿病病程久、高 TG 和 UAER 是并发糖尿病肾病的独立危险因素;而高 SBP、DBP、HbA1c、TC 和 TG 是并发周围神经病变的独立危险因素($P<0.05$)。这与李青等[15]研究有相似之处,但本研究相较于先前研究进一步明确了周围神经病变发病的独立危险因素,对于不同老年糖尿病微血管并发症高危人群的临床预防和控制来说指导价值更高。推测原因在于,不同并发症的病理基础各不相同,老年患者患糖尿病病程时间越长,SBP 和 HbA1c 越高,视网膜组织长期缺氧,视网膜血管血流动力学异常引发毛细血管病变,使糖尿病视网膜病变的发生率显著升高[16]。糖尿病病程久、高 TG 和 UAER 的老年患者因高糖导致糖脂代谢紊乱,脂肪过度堆积,肾小球内跨毛细血管膜压力平衡被打破,继而引起肾小球血流动力学异常,影响肾小球正常形态及功能[17],

使糖尿病肾病的发生风险提升。高SBP、DBP、HbA1c、TC和TG的老年患者机体长期处于慢性高糖、高血压和异常糖脂代谢状况，患者体内产生糖毒性作用引发氧化应激反应、蛋白质非酶糖基化和山梨醇旁路的异常激活，使神经细胞发生渗透性损伤从而造成神经传导障碍[18]，增加周围神经病变的发生风险。

综上所述，老年糖尿病患者发生微血管并发症的患病率较高，糖尿病病程、SBP、DBP、HbA1c、TC、TG和UAER是其发病的危险因素，临床在治疗老年糖尿病患者时，需加强对病程久、血糖、血压和血脂异常患者各项指标的监测，控制各项指标的稳定性，从而降低微血管病变的发病率，改善老年患者的预后。然而，本研究也存在一定的不足之处，如回顾性分析，所有资料均来自医院电子病历数据库，可能会对研究结果产生一定影响，后续会考虑在地区间进行前瞻性研究调查，进一步扩大样本量从而提供更全面的数据，提高研究结果的可靠性。

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