Comparison of serum biochemistry between specific pathogen-free and coventional aged Wistar rats

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Abstract: Objective To investigate the differences in serum biochemistry between specific pathogen-free (SPF) and conventional aged Wistar rats. **Methods** Coulter-JT Analyzer was used to measure the values of serum biochemistry in the two grades of rats. **Results** The serum levels of alanine aminotransferase (ALT), total protein (TP), alkaline phosphatase (ALP), total cholesterol (TC), triglyceride (TG), blood urea nitrogen (BUN), creatinine, Fe, P, glucose, uric acid (UA), and low density lipoprotein (LDL) were very significantly different between male and female Wistar rats of either conventional or SPF grade ($P<0.01$), which also had significant difference in albumin, lactate dehydrogenase (LDH) and apolipoprotein B (ApoB) ($P<0.05$). Between male aged Wistar rats of the two grades, the differences of TP, albumin, albumin/globulin (A/G) ratio, TC, TG, blood glucose, ApoA1, ApoB, UA, high-density lipoprotein (HDL), LDL, and glutamic oxalacetic transaminase (GOT) were very significant ($P<0.01$), with also significant differences in ALT, Fe, Mg ($P<0.05$). Between the female rats of the two grades, the serum levels of ALT, TP, albumin, A/G ratio, ALP, TG, BUN, creatinine, Fe, ApoA1, APOB, HDL, LDL, and bile acids were very significantly different ($P<0.01$), and Mg was significantly different ($P<0.05$). **Conclusion** Different microbiological profiles affect serum biochemistry of aged Wistar rats.

Key words: Wistar rats, aged; specific pathogen-free; serum biochemistry

In order to improve the quality of laboratory animals for animal research, China modified the standards of laboratory animals after World Trade Organization (WTO) entry, especially those for the microbiological classification. The classification of conventional rats has been abolished, first in Beijing and Guangdong Province in 2001, and now specific pathogen-free (SPF) laboratory animals have been widely adopted in medical researches.

It has been found that the serum biochemistry of SPF rats, especially the aged rats, is significantly different from that of the conventional rats. But currently no documentation of the serum biochemical profiles is available, so that difficulty may arise in accurate analy sis of the results obtained from the SPF rats. In this study, we examined the serum biochemical profiles of aged SPF Wistar rats using automatic blood biochemical analyzer in comparison with those of the conventional rats.

MATERIALS AND METHODS

Laboratory animals

Thirty aged conventional rats (500–600 d), half male and half female weighing 420–600 g, were provided by the Department of Medical Research of Guangzhou General Hospital of Guangzhou Command (licensed for breeding). Thirty aged SPF Wistar rats (500–600 d) with equal number of the sex weighing 420–600 g were provided by the Experimental Animal Center of First Military Medical University, with certificate for commercial purposes issued by Guangdong Province.

Blood sample collection and testing

After a 12 h fasting with also deprivation of water, all Wistar rats were anaesthetized with the compounds of ketamine, promethazine and atropine (volume ratio of 2:2:1), and 3 ml blood was drawn with syringe from the heart for testing. Coulter-JT automatic biochemical analyzer manufactured by Coulter Instrument Co. (USA) was used for the measurement.

Statistical analysis

The data were analyzed by SPSS 10.0 software and expressed as *Mean*±*SD*. Comparisons of serum biochemical measurements between aged SPF and conventional Wistar rats were performed using one-way ANOVA.

RESULTS

Tab.1 lists the comparison of serum biochemistry between the SPF and conventional aged Wistar rats.

The serum levels of alanine aminotransferase (ALT), total protein (TP), alkaline phosphatase (ALP), total cholesterol (TC), triglyceride (TG), blood urea nitrogen (BUN), creatinine, Fe, P, blood glucose, uric acid (UA), and low-density lipoprotein (LDL) were very significantly different between male and female aged SPF Wistar rats ($P<0.01$), with also significant differ-

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ences in albumin, LDH and APOB (P<0.05).

Between male aged Wistar rats of the two grades, the differences of TP, albumin, A/G ratio, TC, TG, blood glucose, APOA-1, APOB, UA, HDL, LDL, and glutamic oxalacetic transaminase (GOT) were very significant (P<0.01), and ALT, Fe, as well as Mg also differed significantly (P<0.05).

Between female aged Wistar rats of the two grades, the differences of ALT, TP, albumin, ABG, ALP, TG, BUN, CRE, Fe, APOA-1, APOB, HDL, LDL, and bile acid were very significant (P<0.01), with also significant difference in Mg (P<0.05).

Tab.1 Comparison of serum biochemistry between aged SPF and conventional Wistar rats (*Mean±SD*)

Indices	Unit	SPF (n=30)		Conventional (n=30)		F value	P value
		Male	Female	Male	Female		
ALT	U/L	47.5±6.98	37.1±9.05**	54.7±7.4▲	73.4±7.7##	57.2	0.00
TP	g/L	61.7±2.10	64.6±1.96**	67.5±2.49▲▲	71.1±4.53##	27.5	0.00
Albumin	g/L	43.1±1.77	44.7±1.79*	38.4±1.14▲▲	34.8±3.01##	73.4	0.00
A/G ratio		2.31±0.14	2.28±0.13	1.31±0.08▲▲	0.96±0.17##	376.5	0.00
ALP	U/L	144±6.95	85.1±13.1**	126.1±24.0	177±79.2##	12.5	0.00
TC	mmol/L	2.11±0.07	1.62±0.12**	1.68±0.12▲▲	1.53±0.19	52.9	0.00
TG	mmol/L	2.14±0.35	1.80±0.41**	1.43±0.37▲▲	0.78±0.10##	47.3	0.00
BUN	mmol/L	8.65±0.36	7.36±0.72**	8.27±1.04	9.10±1.54##	7.9	0.00
Creatinine	μmol/L	48.87±4.4	38.0±3.38**	10.4±2.70	66.5±6.22##	48.4	0.00
Fe	μmol/L	41.9±3.02	65.7±7.30**	36.5±6.88▲	41.2±4.26##	80.5	0.00
LDH	U/L	1 218±278	978±218*	1 167±437	1 113±160	1.86	0.15
P	μmol/L	2.17±0.16	1.88±0.10**	2.13±0.24	1.96±0.24	7.17	0.00
Blood glucose	μmol/L	8.18±1.09	9.07±0.37**	10.1±0.87▲▲	9.12±0.82	14.5	0.00
Mg	μmol/L	0.91±0.07	0.91±0.05	0.96±0.04▲	0.97±0.05#	5.26	0.00
ApoA1	g/L	0.00	0.00	0.02±0.005▲▲	0.02±0.01##	99.56	0.00
ApoB	g/L	0.35±0.04	0.42±0.03*	0.04±0.005▲▲	0.04±0.05##	1 212.3	0.00
Uric acid	μmol/L	86.2±23.5	61.2±14.8**	64.0±12.5▲▲	64.0±12.5	27.9	0.00
HDL	mmol/L	0.60±0.03	0.58±0.04	0.71±0.07▲▲	0.71±0.07##	29.26	0.00
LDL	mmol/L	0.22±0.03	0.11±0.08**	0.18±0.04▲▲	0.16±0.33##	44.0	0.00
GOT	U/L	174±34.5	158±54	135.2±43.1▲▲	150±21.4	2.53	0.66
PBA	μmol/L	11.8±4.34	14.2±4.76	12.4±5.94	26.2±5.2##	26.56	0.00

*P<0.01, **P<0.05 *vs* male SPF rats;▲P<0.01,▲▲P<0.05 *vs* male SPF rats; #P<0.01, ##P<0.05 *vs* female SPF rats

DISCUSSION

SPF laboratory animals are bred in a barrier system and strictly isolated from microorganisms, thereby various pathogens likely to influence the animal products and results of animal experiments are eliminated [1] for ensuring the accuracy and reliability of the results of the animal experiments. Such an advantage of the animals in life science researches has been recognized by worldwide researchers [2].

In China, SPF rats have been widely adopted since the abolishment of the classification of conventional rats. The aged SPF Wistar rats have also become the primary choice for researches in geriatrics that is attracting increasing attentions at present [3-4]. The statistical investigation of serum biochemical indices in aged SPF and conventional rats have not been reported yet in China. The results of this study showed that different microbiological grades significantly affected the serum biochemistry of these rats, a finding that may provide valuable reference for future medical researches with such animals.

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两种微生物学等级老龄 Wistar 大鼠血清生化值比较

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摘要:目的 探讨普通级、SPF 级老龄 Wistar 大鼠血清生化值的差异。方法 用 Coulter-JT 全自动生化检测仪检测血清生化值。结果 在老年 SPF 级 Wistar 大鼠的雌性与雄性之间,谷丙酶、总蛋白、碱性磷酸酶、总胆固醇、甘油三酯、尿素氮、肌酐、铁、磷、血糖、尿酸、低密度脂蛋白差异非常显著 ($P<0.01$),白蛋白、乳酸脱氢酶、载脂蛋白 B 差异显著 ($P<0.05$)。老年 SPF 级雄性 Wistar 大鼠与老年普通级雄性 Wistar 大鼠间的总蛋白、白蛋白、白球比、总胆固醇、甘油三酯、血糖、载脂蛋白 A1、载脂蛋白 B、尿酸、高密度脂蛋白、低密度脂蛋白、谷草酶差异非常显著 ($P<0.01$),谷丙酶、铁、镁差异显著 ($P<0.05$)。老年 SPF 级雌性 Wistar 大鼠与普通级雌性 Wistar 大鼠间的谷丙酶、总蛋白、白蛋白、白球比、碱性磷酸酶、甘油三酯、尿素氮、肌酐、铁、载脂蛋白 A1、载脂蛋白 B、高密度脂蛋白、低密度脂蛋白、胆汁酸差异非常显著 ($P<0.01$),镁含量差异显著 ($P<0.05$)。结论 微生物学等级因素对 Wistar 大鼠的血清生化值有影响。

关键词:老龄,SPF,Wistar 大鼠,血清生化值
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新生儿惊厥 115 例病因分析

Convulsion in neonates: report of 115 cases

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关键词:新生儿;惊厥 / 病因学
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我科自 1999 年至 2003 年共收治新生儿 1 206 例,其中出现惊厥 115 例,现将其临床特点及病因分析如下:

1 临床资料

1.1 一般资料

115 例中男 70 例、女 45 例;第一胎 63 例,第二胎以上 52 例;发病时间:3 d 内发病者 52 例,3~7 d 者 41 例,>7 d 者 22 例,最小为 1 h,最长为 26 d;早产儿 51 例,足月产儿 60 例,过期产儿 4 例;入院时体质量≤1 500 g 3 例、1 500~2 500 g 50例、2 500~4 000 g 59 例、>4 000 g 3 例;经阴道分娩 48 例、剖宫产 67 例 10 例、负压吸引 12 例、产钳助产 8 例、脐带绕颈 14 例。

1.2 病因分析

窒息所至缺血缺氧性脑病或(及)颅内出血 68 例;破伤风 13 例,肺炎 12 例,败血症 4 例;低钙血症 10 例,新生儿高胆红素血症并核黄疸 3 例;晚发性维生素 K 缺乏 2 例;撤药综合征 3 例。

1.3 发作类型

根据国内新生儿惊厥发作形式分类[1],微小型 28 例;局灶阵挛型 17 例;肌阵挛型 9 例;强直型 10 例;2 种以上类型同时并存者 37 例。

1.4 辅助检查

115 例血生化检查低血钙 23 例,低血糖 6 例,低血钠 4 例;72 例作头颅 CT 检查,其中 65 例有脑损伤改变,主要表现为脑水肿、脑组织密度减低和 / 或颅内出血;45 例患儿作脑电图检查,31 例表现为轻、中度脑电活动降低和尖波。

1.5 治疗与预后

根据不同病因作相应治疗,如止血、降颅压、早期干预、抗感染、补钙、止惊等。惊厥在 1~2 d 控制者 83 例,3~5 d 控制者22例,>5 d 3 例;自动出院 5 例,死亡 9 例,其中早产儿死亡 5 例。死亡原因有肺出血 4 例,颅内出血 2 例,DIC 1 例,破伤风 2 例。

2 讨论

新生儿惊厥发生率较高(4.5%~21.67%)[2],我院新生儿惊厥发生率为 9.54%。而新生儿惊厥发作的形式很不典型,大部分病例表现为微小型发作或局灶阵挛型,有时难以与足月婴儿的正常活动区别,应仔细观察以免漏诊。本组资料显示出生 3 d内的新生儿惊厥最常见的原因是窒息所至缺血缺氧性脑病或(及)颅内出血,尤其是围产期缺氧性脑损伤。故一旦发生惊厥,必须迅速找出病因,在控制惊厥的同时治疗颅脑损伤。应详细询问产科病史和分娩经过,结合胎龄、出生体重,必要时进行生化检查和头颅 CT 检查。感染性疾病占本组新生儿惊厥的第二位,其中破伤风占 13 例,死亡 2 例。有效控制感染,可降低死亡率。

新生儿惊厥的第三大原因是低血钙,也常发生在生后 3 d 内。故对可能发生低血钙的患儿,应在补钙的同时针对不同的病因及早采取相应措施[3]。

值得注意的是近几年来,因为各种原因瘾君子增多,而出现新生儿撤药综合症的增加,常于生后 1~2 d 出现兴奋症状,主要表现为较明显的植物神经系统症状及中枢神经系统兴奋症状、消化系统症状等。

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