论著·临床研究

# 多发伤患者血清高迁移率族蛋白B1及可溶性髓样细胞触发受体-1水平变化及预后意义

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［摘要］**目的·**检测多发伤患者不同时间点的血清高迁移率族蛋白B1（high mobility group box 1，HMGB1）及可溶性髓样细胞触发受体-1（soluble triggering receptor expressed on myeloid cell-1，sTREM-1）水平，并分析其与病情严重程度、并发症及预后的相关性。**方法·**选取2020年12月至2022年12月在苏州市第九人民医院急诊科收治的多发伤患者92例，根据患者入院时的损伤严重程度评分将患者分为轻伤组（$n$=24）、重伤组（$n$=58）、严重伤组（$n$=10）；依据入院后是否合并多器官功能障碍综合征（multiple organ dysfunction syndrome，MODS）将患者分为MODS组（$n$=20）和非MODS组（$n$=72）；根据创伤发生后28 d内结局将患者分为死亡组（$n$=13）和存活组（$n$=79）。检测患者入院后静脉血炎症因子指标。采用酶联免疫吸附试验（enzyme linked immunosorbent assay，ELISA）检测创伤发生后24 h、72 h及7 d的血清HMGB1、sTREM-1水平。分析不同分组间血清HMGB1、sTREM-1水平的差异，并采用多因素Logistic回归分析多发伤患者不良结局的影响因素。运用受试者工作特征（receiver operating characteristics，ROC）曲线评估HMGB1、sTREM-1对不良结局的预测价值。**结果·**重伤和严重伤组各时间点HMGB1、sTREM-1水平明显高于轻伤组（均$P$<0.05），严重伤组创伤发生后72 h和7 d的HMGB1水平及24 h和72 h的sTREM-1水平明显高于重伤组（均$P$<0.05）。各时间点HMGB1与sTREM-1水平呈正相关性（$r$=0.645，$r$=0.942，$r$=0.722；均$P$<0.05）。MODS组创伤发生后72 h和7 d的HMGB1水平及24 h和72 h的sTREM-1水平明显高于非MODS组（均$P$<0.05）；死亡组创伤发生后72 h和7 d的HMGB1水平及24 h、72 h的sTREM-1水平明显高于存活组（均$P$<0.05）。Logistic回归分析显示，创伤发生后7 d的HMGB1水平及入院时间、超敏C反应蛋白（hypersensitive C-reactive protein，hs-CRP）水平是多发伤患者不良结局的独立影响因素（均$P$<0.05）。ROC曲线显示，创伤发生后7 d的HMGB1水平预测不良预后的曲线下面积为0.890，敏感度为83.5%，特异度为92.3%。**结论·**多发伤患者创伤发生后不同时间点HMGB1及sTREM-1水平与MODS及生存结局相关，且创伤发生后7 d的HMGB1水平是多发伤患者不良结局的独立影响因素。

［关键词］多发伤；高迁移率族蛋白B1；可溶性髓样细胞触发受体-1；预后
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# Changes of serum high mobility group box 1 and soluble triggering receptor expressed on myeloid cells-1 in patients with multiple injuries and their prognostic significance

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**[Abstract]** **Objective·**To detect the serum levels of high mobility group box 1 (HMGB1) and soluble triggering receptor expressed on myeloid cells-1 (sTREM-1) in patients with multiple injuries at different time points, and to analyze their correlation with disease severity, complications and prognosis. **Methods·**Ninety-two patients with multiple injuries admitted to the Department of Emergency Medicine of the Suzhou Ninth People's Hospital from December 2020 to December 2022 were selected. According to the injury severity scores of the patients at admission, the patients were divided into light injury group ($n$=24), grave injury group ($n$=58) and severe injury group ($n$=10). According to whether there was multiple organ dysfunction syndrome (MODS) after admission, the patients were divided into MODS group ($n$=20) and non-MODS group ($n$=72). According to the outcome within 28 d after trauma, the patients were divided into death group ($n$=13) and survival group ($n$=79). Inflammatory factor indicators in venous blood of patients after admission were detected. Enzyme linked immunosorbent assay (ELISA) was used to detect the serum HMGB1 and

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sTREM-1 levels at 24 h, 72 h and 7 d after trauma, and the differences of serum HMGB1 and sTREM-1 levels among different groups were analyzed. Multiple Logistic regression was used to analyze the influencing factors of adverse outcomes in patients with multiple injuries. The receiver operating characteristic (ROC) curve was used to evaluate the predictive value of HMGB1 and sTREM-1 for adverse outcomes. **Results**·The levels of HMGB1 and sTREM-1 in the grave injury and severe injury groups were significantly higher than those in the light injury group ($P$<0.05). The levels of HMGB1 at 72 h and 7 d, and sTREM-1 at 24 h and 72 h in the severe injury group were significantly higher than those in the grave injury group ($P$<0.05). There was a positive correlation between HMGB1 and sTREM-1 levels at various time points ($r$=0.645, $r$=0.942, $r$=0.722; all $P$<0.05). The levels of HMGB1 at 72 h and 7 d, and sTREM-1 at 24 h and 72 h in the MODS group were significantly higher than those in the non-MODS group (all $P$<0.05). The levels of HMGB1 at 72 h and 7 d, and sTREM-1 at 24 h and 72 h in the death group were significantly higher than those in the survival group (all $P$<0.05). Logistic regression analysis showed that HMGB1 at 7 d, admission time and hypersensitive C-reactive protein (hs-CRP) were independent factors of adverse outcomes in patients with multiple injuries (all $P$<0.05). The ROC curve showed that the area under the curve of HMGB1 for predicting poor prognosis at 7 days after trauma was 0.890, the sensitivity was 83.5%, and the specificity was 92.3%. **Conclusion**·The levels of HMGB1 and sTREM-1 are correlated with MODS and survival outcomes in patients with multiple injuries at different time points after trauma, and HMGB1 at 7 d after trauma is an independent factor affecting adverse outcomes in patients with multiple injuries.

**[Key words]** multiple injury; high mobility group box 1 (HMGB1); soluble triggering receptor expressed on myeloid cell-1 (sTREM-1); prognosis

多发伤指由1个致病因素导致2个及以上组织或器官的创伤，具有创伤程度重、病情变化快及易进展等特点，患者死亡风险较高[1-2]。准确评估病情的严重程度及预后，并进行合理临床决策，是降低并发症和死亡率、改善患者预后的关键。研究[3-4]证实，多发伤患者存在全身性的炎症水平升高，且与多发伤病情进展有关。高迁移率族蛋白B1（high mobility group box 1，HMGB1）是革兰阴性菌脂多糖、白介素和肿瘤坏死因子α（tumor necrosis factor α，TNF-α）等刺激巨噬细胞后产生的一种蛋白质，是重要的晚期炎症介质之一[5]。可溶性髓样细胞触发受体-1（soluble triggering receptor expressed on myeloid cell-1，sTREM-1）是近年来发现的炎症反应激发受体，也被证实在炎症触发和放大过程中具有重要意义[6]。目前有证据[7]显示，HMGB1与sTREM-1具有相关性。同时还有研究[8-9]发现，多发伤患者HMGB1及sTREM-1水平明显升高，且HMGB1及sTREM-1高水平患者预后较差。但关于多发伤患者创伤发生后不同时间点HMGB1和sTREM-1水平变化及其与病情严重程度、并发症及死亡的相关性研究尚不多见，相关结论也不够明确。因此，本研究通过检测多发伤患者创伤发生后24 h、72 h及7 d时的血清HMGB1及TREM-1水平，分析患者HMGB1及sTREM-1变化与病情严重程度、并发症及死亡的相关性，以期为患者病情判断、预后评估及干预措施的研究提供依据，从而辅助临床合理决策，改善患者预后。

## 1　资料与方法

### 1.1　研究对象

选取2020年12月至2022年12月在苏州市第九人民医院急诊科收治的多发伤患者92例作为研究对象。纳入标准：① 年龄18~65岁。② 符合《多发伤病历与诊断：专家共识意见（2013版）》的多发伤诊断标准[10]。③ 创伤发生至入院不超过6 h。④ 入院后生存时间>7 d，且有最长28 d随访记录。⑤ 患者或家属对本研究知情同意。排除标准：① 合并感染性疾病、免疫疾病等。② 合并恶性肿瘤者。③ 怀孕或哺乳期患者。④ 中途转院或放弃治疗者。根据患者入院时的损伤严重程度评分（injury severity score，ISS）[11]将患者分为轻伤组（ISS<16，$n$=24）、重伤组（16≤ISS≤25，$n$=58）、严重伤组（ISS>25，$n$=10）；依据入院后是否合并多器官功能障碍综合征（multiple organ dysfunction syndrome，MODS）[12]分为MODS组（$n$=20）和非MODS组（$n$=72）；根据创伤发生后28 d内结局将患者分为死亡组（$n$=13）和存活组（$n$=79）。

### 1.2　研究方法

1.2.1　资料收集　收集患者一般及临床资料，包括年龄、性别、有无基础疾病、入院时间、致伤因素、主要创伤部位及数量、是否急诊手术、是否大量输血。统计患者住院期间MODS发生情况及创伤发生后28 d内的存活情况。

1.2.2 ISS及格拉斯哥昏迷评分 患者入院后立即行ISS评分及格拉斯哥昏迷评分（Glasgow coma score，GCS）评估。ISS评分：将人体划分为头颈部、面部、胸部、腹部、四肢/骨盆、体表6个部分，每个部分得分按照简明损伤评分（abbrebiated injury scale，AIS）计算（1~5分）；取评分最高的3个AIS值的平方和即为ISS分值，最高75分。GCS评分：依据睁眼反应、语言反应、运动反应的不同情况进行评分和分级，最高15分。

1.2.3 指标检测 患者入院后2 h内收集静脉血，采用全自动血凝分析仪检测患者活化部分凝血酶原时间（activated partial thromboplastin time，APTT）及D-二聚体（D-dimer，DD）水平；全自动生化分析仪检测超敏C反应蛋白（hypersensitive C-reactive protein，hs-CRP）水平；采用双抗夹心免疫化学发光法检测降钙素原（procalcitonin，PCT）水平。抽取患者创伤发生后24 h、72 h和7 d时的静脉血，离心收集血清，置于−80 ℃冰箱中保存。采用酶联免疫吸附试验（enzyme linked immunosorbent assay，ELISA）试剂盒（北京索莱宝科技有限公司）检测血清HMGB1、sTREM-1及白细胞介素-6（interleukin-6，IL-6）水平。

### 1.3 统计学分析

采用SPSS 19.0软件进行统计学处理。服从正态分布的定量资料用$\bar{x}\pm s$表示，2组间比较采用独立样本$t$检验，多组间比较采用单因素方差分析，组间两两比较采用最小显著差异（least significant difference，LSD）-$t$检验。定性资料以频数（百分率）表示，组间比较采用Fisher确切概率法检验。同一指标不同时间点比较采用重复测量分析。相关性分析采用Pearson相关。采用多因素Logistic回归分析不良结局的影响因素。运用受试者工作特征（receiver operating characteristics，ROC）曲线评估HMGB1、sTREM-1对不良结局的预测价值。$P$<0.05表示差异有统计学意义。

## 2 结果

### 2.1 不同严重程度多发伤患者HMGB1、sTREM-1水平变化

不同严重程度多发伤患者HMGB1和sTREM-1水平均随着时间变化而变化（均$P$<0.05），其中HMGB1水平随时间的增加而增加，sTREM-1水平先增加后降低。重伤和严重伤组创伤发生后24 h、72 h和7 d的HMGB1和sTREM-1水平均明显高于轻伤组，差异有统计学意义（均$P$<0.05）；严重伤组创伤发生后72 h和7 d的HMGB1水平及24 h和72 h的sTREM-1水平明显高于重伤组，差异有统计学意义（均$P$<0.05）。结果见表1。

**表1 不同严重程度多发伤患者HMGB1、sTREM-1水平比较**

**Tab 1** Comparison of HMGB1 and sTREM-1 levels in patients with multiple injuries of different severity

| Variable | Light injury group ($n$=24) | Grave injury group ($n$=58) | Severe injury group ($n$=10) | $P$ value③ | $P$ value④ | $P$ value⑤ |
|---|---|---|---|---|---|---|
| HMGB1/(ng·mL$^{-1}$)① | | | | | | |
| 24 h | 2.47±0.61 | 2.86±0.65 | 2.99±0.52 | 0.013 | 0.030 | 0.531 |
| 72 h | 3.12±0.73 | 3.57±0.66 | 4.22±0.31 | 0.006 | 0.000 | 0.005 |
| 7 d | 3.63±0.83 | 4.19±0.77 | 4.96±0.35 | 0.003 | 0.000 | 0.004 |
| sTREM-1/(ng·mL$^{-1}$)② | | | | | | |
| 24 h | 11.71±3.00 | 13.43±2.65 | 15.38±1.95 | 0.010 | 0.000 | 0.037 |
| 72 h | 12.77±3.47 | 14.46±2.74 | 16.51±1.99 | 0.017 | 0.001 | 0.041 |
| 7 d | 5.52±1.24 | 6.47±1.25 | 6.72±1.20 | 0.006 | 0.015 | 0.463 |

**Note:** ①$F_{group}$=9.579, $P_{group}$=0.000; $F_{time}$=295.409, $P_{time}$=0.000; $F_{time\times group}$=4.137, $P_{time\times group}$=0.002. ②$F_{group}$=7.262, $P_{group}$=0.001; $F_{time}$=427.712, $P_{time}$=0.000; $F_{time\times group}$=2.598, $P_{time\times group}$=0.038. ③$P$ value of comparison between the light injury group and the grave injury group; ④$P$ value of comparison between the light injury group and the severe injury group; ⑤$P$ value of comparison between the grave injury group and the severe injury group.

### 2.2 HMGB1与sTREM-1水平的相关性分析

相关性分析结果显示，各时间点HMGB1水平与sTREM-1水平均呈明显正相关性（$r$=0.645，$r$=0.942，$r$=0.722；均$P$=0.000）。结果见图1。

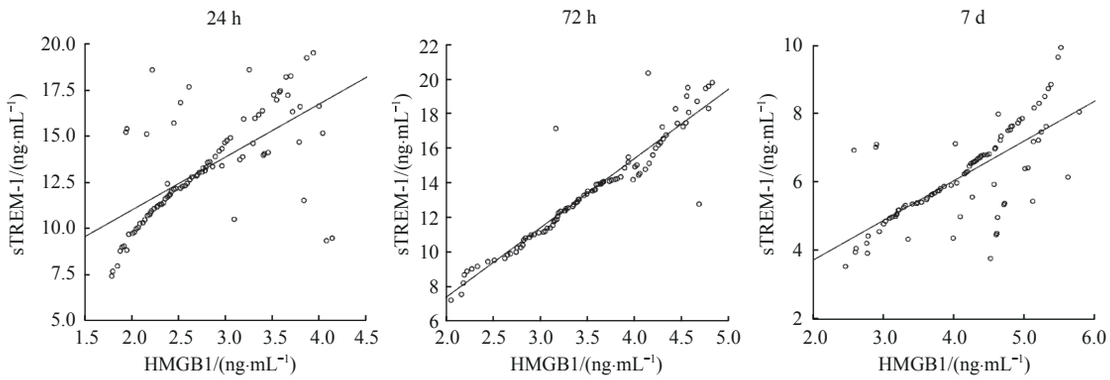


**图1　HMGB1与sTREM-1水平的相关性分析**

**Fig 1**　Correlation analysis of HMGB1 and sTREM-1 levels

## 2.3　MODS组和非MODS组多发伤患者HMGB1、sTREM-1水平变化

MODS组和非MODS组患者HMGB1和sTREM-1水平均随着时间变化而变化（$P$<0.05），其中HMGB1水平随时间的增加而增加，sTREM-1水平先增加后降低。MODS组创伤发生后72 h和7 d的HMGB1水平及24 h和72 h的sTREM-1水平明显高于非MODS组，差异有统计学意义（$P$=0.011，$P$=0.008，$P$=0.020，$P$=0.014）。结果见表2。

**表2　MODS组和非MODS组HMGB1、sTREM-1水平比较**

**Tab 2**　Comparison of HMGB1 and sTREM-1 levels between the MODS group and the non-MODS group

| Variable | Non-MODS group ($n$=72) | MODS group ($n$=20) | $P$ value |
|---|---|---|---|
| HMGB1/(ng·mL$^{-1}$)① | | | |
| 24 h | 2.71±0.65 | 2.99±0.60 | 0.086 |
| 72 h | 3.42±0.70 | 3.88±0.66 | 0.011 |
| 7 d | 4.01±0.82 | 4.57±0.76 | 0.008 |
| sTREM-1/(ng·mL$^{-1}$)② | | | |
| 24 h | 12.83±2.77 | 14.50±2.87 | 0.020 |
| 72 h | 13.84±2.96 | 15.71±2.97 | 0.014 |
| 7 d | 6.07±1.20 | 6.69±1.71 | 0.069 |

**Note:** ①$F_{group}$=6.665, $P_{group}$=0.011; $F_{time}$=297.586, $P_{time}$=0.000; $F_{time\times group}$=2.233, $P_{time\times group}$=0.113.　②$F_{group}$=6.178, $P_{group}$=0.015; $F_{time}$=425.947, $P_{time}$=0.000; $F_{time\times group}$=2.511, $P_{time\times group}$=0.087.

## 2.4　HMGB1、sTREM-1水平与多发伤患者预后的关系

### 2.4.1　存活组和死亡组基本资料比较

死亡组与存活组入院时间、主要创伤部位分布、病情严重程度、MODS发生率及hs-CRP、IL-6、PCT水平比较，差异有统计学意义（均$P$<0.05），而2组间其他资料比较，差异无统计学差异（$P$>0.05）。结果见表3。

**表3　存活组和死亡组基本资料比较**

**Tab 3**　Comparison of basic data between the survival group and the death group

| Variable | Survival group ($n$=79) | Death group ($n$=13) | $t/\chi^2$ value | $P$ value |
|---|---|---|---|---|
| Age/year | 42.53±11.64 | 47.31±11.71 | 1.369 | 0.174 |
| Gender/$n$(%) | | | 0.837 | 0.546 |
| Male | 44 (55.70) | 9 (69.23) | | |
| Female | 35 (40.30) | 4 (30.77) | | |
| Background disease/$n$(%) | | | 0.387 | 0.747 |
| Yes | 25 (31.65) | 3 (23.08) | | |
| No | 54 (68.35) | 10 (76.92) | | |
| Admission time/h | 4.43±0.92 | 5.00±0.51 | 3.259 | 0.003 |
| Injury factor/$n$(%) | | | 1.224 | 0.570 |
| Transportation | 54 (68.35) | 8 (61.54) | | |
| Fall accident from high place | 19 (24.05) | 3 (23.08) | | |
| Other | 6 (7.59) | 2 (15.38) | | |
| Number of wound sites/$n$ | 2.66±0.64 | 2.92±0.49 | 1.425 | 0.158 |

Continued Tab

| Variable | Survival group ($n$=79) | Death group ($n$=13) | $t/\chi^2$ value | $P$ value |
|---|---|---|---|---|
| Primary trauma site/$n$(%) | | | 7.400 | 0.042 |
| Head | 32 (40.51) | 11 (84.62) | | |
| Chest | 27 (34.18) | 1 (7.69) | | |
| Abdomen | 14 (17.72) | 1 (7.69) | | |
| Limbs and pelvis | 6 (7.59) | 0 (0) | | |
| Emergency operation/$n$(%) | | | 2.391 | 0.181 |
| Yes | 20 (25.32) | 6 (46.15) | | |
| No | 59 (74.68) | 7 (53.85) | | |
| Massive transfusion/$n$(%) | | | 4.778 | 0.055 |
| Yes | 24 (34.18) | 8 (61.54) | | |
| No | 55 (65.82) | 5 (38.46) | | |
| Severity/$n$(%) | | | 19.475 | 0.000 |
| Lightly injury | 22 (27.85) | 2 (15.38) | | |
| Gravely injury | 54 (68.35) | 4 (30.77) | | |
| Severe injury | 3 (3.80) | 7 (53.85) | | |
| GCS score/score | 10.31±2.04 | 9.51±2.27 | 1.286 | 0.202 |
| APTT/s | 30.31±5.02 | 32.97±5.91 | 1.727 | 0.088 |
| DD/(mg·L$^{-1}$) | 0.81±0.37 | 0.89±0.29 | 0.770 | 0.443 |
| MODS/$n$(%) | | | 5.304 | 0.032 |
| Yes | 14 (17.72) | 6 (46.15) | | |
| No | 65 (82.28) | 7 (53.85) | | |
| hs-CRP/(mg·L$^{-1}$) | 18.74±3.98 | 21.79±3.28 | 2.612 | 0.011 |
| IL-6/(pg·mL$^{-1}$) | 65.16±14.11 | 78.33±10.46 | 3.215 | 0.002 |
| PCT/(ng·mL$^{-1}$) | 4.06±0.90 | 5.02±0.91 | 3.560 | 0.001 |

2.4.2 存活组和死亡组HMGB1、sTREM-1水平变化 2组患者HMGB1和sTREM-1水平均随着时间变化而变化（$P$<0.05），其中HMGB1水平随时间的增加而增加，sTREM-1水平先增加后降低。死亡组创伤发生后72 h和7 d的HMGB1水平及24 h和72 h的sTREM-1水平明显高于存活组，差异有统计学意义（均$P$=0.000）。结果见表4。

2.4.3 多发伤患者生存结局的多因素Logistic回归分析 以创伤发生后28 d内患者生存与否为因变量，以入院时间，主要创伤部位，病情严重程度，hs-CRP、IL-6、PCT水平，是否发生MODS，以及创伤发生后72 h和7 d的HMGB1及24 h和72 h的sTREM-1水平为自变量，进行多因素Logistic回归分析，方法为“条件-向前”。结果显示，创伤发生后7 d的HMGB1水平（$OR$=35.600，$P$=0.011）、入院时间（$OR$=3.743，$P$=0.042）及hs-CRP水平（$OR$=1.516，$P$=0.004）是多发伤患者创伤发生后28 d死亡的独立危险因素。结果见表5。

**表4 存活组和死亡组HMGB1、sTREM-1水平比较**

**Tab 4** Comparison of HMGB1 and sTREM-1 levels between the survival group and the death group

| Variable | Survival group ($n$=79) | Death group ($n$=13) | $P$ value |
|---|---|---|---|
| HMGB1/(ng·mL$^{-1}$)① | | | |
| 24 h | 2.73±0.65 | 3.05±0.57 | 0.096 |
| 72 h | 3.40±0.69 | 4.23±0.43 | 0.000 |
| 7d | 3.97±0.79 | 5.07±0.44 | 0.000 |
| sTREM-1/(ng·mL$^{-1}$)② | | | |
| 24 h | 12.78±2.75 | 15.70±2.21 | 0.000 |
| 72 h | 13.68±2.79 | 17.66±2.23 | 0.000 |
| 7 d | 6.16±1.30 | 6.92±1.20 | 0.106 |

**Note:** ①$F_{group}$=15.605, $P_{group}$=0.000; $F_{time}$=483.956, $P_{time}$=0.000; $F_{time\times group}$=25.217, $P_{time\times group}$=0.000. ②$F_{group}$=16.038, $P_{group}$=0.000; $F_{time}$=667.811, $P_{time}$=0.000; $F_{time\times group}$=21.683, $P_{time\times group}$=0.000.

2.4.4 ROC曲线分析 由于多因素Logistic回归分析结果可以看出，创伤发生后7 d的HMGB1水平是多发伤患者创伤发生后28 d死亡的独立危险因素。因此采用ROC曲线进一步分析该指标对创伤发生后28 d

**表5　多发伤患者生存结局的多因素Logistic回归分析结果**

**Tab 5**　Multivariate Logistic regression analysis of survival outcomes in patients with multiple injuries

| Variable | *B* | *Wals* | *Sig* | *OR* | 95% *CI* |
|---|---|---|---|---|---|
| Admission time | 1.320 | 4.136 | 0.042 | 3.743 | 1.049–13.358 |
| hs-CRP | 0.416 | 8.247 | 0.004 | 1.516 | 1.141–2.014 |
| $HMGB1_{7\,d}$ | 3.572 | 12.131 | 0.011 | 35.600 | 4.769–265.752 |

死亡的预测价值。结果显示，创伤发生后7 d的HMGB1水平预测28 d死亡的曲线下面积（area under curve，AUC）为0.890（95%*CI* 0.808~0.946），截断值为4.66 ng/mL，敏感度为83.5%，特异度为92.3%。结果见图2。

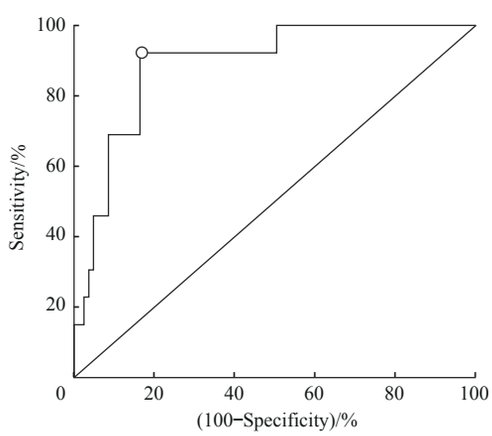


**图2　创伤发生后7 d时血清HMGB1水平预测多发伤患者28 d死亡的ROC曲线分析**

**Fig 2**　ROC curve analysis of serum HMGB1 level for predicting 28 d death in patients with multiple injuries at 7 d after trauma

## 3　讨论

多发伤具有受伤程度重、伤情变化快、感染率和死亡率高及死因复杂等特点，已逐渐成为临床死亡的主要原因之一[13]。因此，早期发现、识别并给予积极、有效的救治及预防相关并发症是降低死亡率的关键。尽管目前临床上也发现了许多评估多发伤严重程度及预后的生化指标，但其早期诊断灵敏度低且特异度不高。因此需要寻找能够在发病早期更加准确判断多发伤患者损伤严重程度和预后的新指标。

HMGB-1是一种重要的染色体结合蛋白，主要参与DNA复制、基因转录调节、稳定染色质结构以及细胞分化等[14-15]。相关研究[16-17]证实，HMGB-1在全身炎症性疾病、自身免疫性疾病以及组织器官炎症疾病等炎症反应过程中发挥重要作用，是一种活跃的晚期炎症反应介质。目前研究[18-19]发现，创伤性损伤患者的血浆HMGB1浓度明显升高，有助于判断患者预后。有研究[20]发现，创伤患者HMGB-1水平显著高于健康者，与院内死亡风险相关。还有研究[21]发现，急性腹部多发伤MODS患者入院1 d内的血清HMGB-1水平均明显高于非MODS患者。本研究结果显示，MODS患者创伤发生后不同时间点HMGB-1水平高于非MODS患者，且死亡组创伤发生后72 h和7 d的HMGB1水平及24 h和72 h的sTREM-1水平均高于存活组，提示HMGB-1水平可能与并发症及预后相关，与既往研究结果一致。多因素Logistic回归分析结果显示，创伤发生后7 d的HMGB1水平是多发伤患者创伤发生后28 d死亡的独立影响因素，说明其与多发伤患者不良结局密切相关。进一步的ROC曲线分析结果显示：创伤发生后7 d的HMGB-1水平预测28 d内死亡的AUC为0.890，敏感度为83.5%，特异度为92.3%，高于IL-6对腹部多发伤生存结局的预测价值（AUC=0.780、敏感度为79.2%，特异度为79.6%）[21]，提示创伤发生后7 d的HMGB-1水平对多发伤患者不良结局具有较高的预测价值。可能是因为HMGB1是一种潜在的晚期时相炎症介质，与早期炎症介质（CRP、IL-1及IL-6等）比较，HMGB1水平变化较晚，持续时间较长，因此从检测时间窗的角度看其可能更适合于创伤患者的病情评估[22]。既往研究[21,23]发现，血清HMGB-1水平对MODS的发生及患者生存结局均具有一定的预测价值。以上结果表明，创伤发生后7 d的HMGB-1水平可作为多发伤患者预后评估的标志物。

sTREM-1是近年来新发现的一种炎症反应激发受体，是一种缺乏跨膜结构域的分泌亚型，在脓毒症、呼吸机相关肺炎及细菌性脑膜炎等感染性疾病的诊断中发挥重要作用[24-25]。目前研究[26-27]发现，sTREM-1与创伤性损伤、全身炎症反应综合征的严重程度及脓毒症的发生发展密切相关。还有研究[28]发现，严重多发伤合并MODS患者伤后1周内的血清sTREM-1水平明显高于未合并MODS患者，且死亡者sTREM-1水平高于存活者。本研究结果显示：多发伤患者入院24 h后sTREM-1水平升高，在创伤发生后72 h达到顶峰，随后趋于降低；且在这一过程中，MODS患者创伤发生后不同时间点sTREM-1水平高于非MODS者；死亡组sTREM-1水平均高于存活组。上述结果提示sTREM-1水平升高可能与并发症及预后相关，与既往研究结果一致。但多因素Logistic回

归分析结果显示，不同时间点sTREM-1水平均不是多发伤患者创伤发生后28 d死亡的独立影响因素。

综上所述，多发伤患者创伤发生后不同时间点血清HMGB1及sTREM-1水平与MODS及生存结局具有一定的相关性，其中创伤发生后7 d的HMGB-1水平可作为多发伤患者预后评估的标志物。但本研究样本量较少，且为单中心研究，因此需要更大样本量的研究来证明多发伤患者血清HMGB1及sTREM-1水平与MODS及生存结局的相关性以及二者是否具有联合预测价值。同时还需进一步开展基础研究阐明HMGB1及sTREM-1参与多发伤进展的机制。

## 利益冲突声明/Conflict of Interests

所有作者声明不存在利益冲突。

All authors disclose no relevant conflict of interests.

## 伦理批准和知情同意/Ethics Approval and Patient Consent

本研究经苏州市第九人民医院临床医学研究伦理委员会审查批准（文件号：KY2022-048-01）。受试对象或家属已经签署知情同意书。

This study was reviewed and approved by the Clinical Medical Research Ethics Committee of Suzhou Ninth People's Hospital (document No. KY2022-048-01). Consent letters have been signed by the research participants or their relatives.

## 作者贡献/Authors' Contributions

王桂杰、杜传冲、陆叶、耿佳财参与实验设计和执行；王桂杰、杜传冲、陆叶、赵健、沈勰和金冬林参与数据收集和分析；王桂杰、耿佳财参与论文写作和修改。所有作者均阅读并同意了最终稿件的提交。

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