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经脐单孔腹腔镜胆囊切除术后切口感染的列线图模型预测价值研究 及防治策略分析*

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摘要 目的: 探讨经脐单孔腹腔镜胆囊切除术后切口感染的列线图模型预测价值及防治策略。**方法:** 回顾性分析 2018 年 10 月-2021 年 5 月合肥市第一人民医院收治的经脐单孔腹腔镜胆囊切除术患者 94 例的临床资料,根据患者术后是否发生切口感染分为感染组 (n=12 例) 和非感染组 (n=82 例)。查阅两组病历资料,对患者术后切口感染的可能影响因素进行单因素及多因素 Logistic 回归分析;引入 R 软件建立经脐单孔腹腔镜胆囊切除术后切口感染预测模型并绘制列线图模型,获得预测风险值;绘制 ROC 曲线,分析列线图模型对术后切口感染的预测效能。**结果:** 94 例经脐单孔腹腔镜胆囊切除术患者中 12 例术后切口发生感染,感染率为 12.77%。多因素 Logistic 回归分析结果表明:年龄、手术时间、住院时间、胆囊破裂是经脐单孔腹腔镜胆囊切除术后切口感染发生的影响因素 ($P<0.05$);列线图模型看出:年龄得分为 63 分,住院时间得分为 37.6 分,手术时间得分为 71.5 分,胆囊破裂得分为 50 分,预测风险值为 2.221,ROC 曲线下面积为 0.832。**结论:** 经脐单孔腹腔镜胆囊切除术后切口感染率较高,且受到

关键词: 经脐单孔腹腔镜胆囊切除术;切口感染;列线图模型;防治策略

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Predictive Value of Nomogram Model for Incision Infection after Transumbilical Single Hole Laparoscopic Cholecystectomy and Analysis of Prevention and Treatment Strategies*

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ABSTRACT Objective: To explore the predictive value and prevention strategy of nomogram model for incision infection after transumbilical single hole laparoscopic cholecystectomy. **Methods:** The clinical data of 94 patients with after transumbilical single hole laparoscopic cholecystectomy who were admitted to Hefei First People's Hospital from October 2018 to May 2021 were retrospectively analyzed. Patients were divided into infection group (n=12 cases) and non-infection group (n=82 cases) according to whether incision infection occurred after surgery. The medical records of the two groups were consulted, and univariate and multivariate Logistic regression analysis was performed on the possible influencing factors of postoperative incision infection. R software was introduced to establish the prediction model of incision infection after transumbilical single hole laparoscopic cholecystectomy and draw the line graph model to obtain the predicted risk value. The ROC curve was drawn and the predictive efficacy of nomogram model for postoperative incision infection was analyzed. **Results:** Among 94 cases of transumbilical single hole laparoscopic cholecystectomy, 12 cases had postoperative incision infection, and the infection rate was 12.77%. Multivariate Logistic regression analysis showed that age, operation time, hospital stay and gallbladder rupture were the influencing factors of incision infection after transumbilical single hole laparoscopic cholecystectomy ($P<0.05$). The nomogram model shows that the age score was 63 scores, the hospital stay score was 37.6 scores, the operation time score was 71.5 scores, the gallbladder rupture score was 50 scores, and the predicted risk value was 2.221, the area under ROC curve is 0.832. **Conclusion:** The incision infection rate after transumbilical single port laparoscopic cholecystectomy is high, and they are affected by many factors. Therefore, the prediction model constructed based on the above factors can achieve high prediction efficiency, and which is worthy of popularization and application.

Key words: After transumbilical single hole laparoscopic cholecystectomy; Incision infection; Nomogram model; Prevention and treatment strategies

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前言

经脐单孔腹腔镜胆囊切除术具有手术创伤性小、术后恢复快及术后并发症发生率低等优点,成为胆囊切除患者首选治疗方法^[1-3]。但是,该手术亦属于一种入侵式操作,再加上经脐单孔腹腔镜胆囊切除术适应证的放宽,导致患者术后切口感染率呈上升趋势,不仅会影响患者术后恢复,亦可影响患者生活质量,严重者将威胁其生命安全^[4,5]。国内学者研究表明^[6]:经脐单孔腹腔镜胆囊切除术后切口感染的发生是一个多因素过程,多数患者由于围术期胆管管受损引起,导致胆管内部充血,引起括约肌痉挛、水肿,造成胆泥发生沉淀,从而引起感染。因此,研究经脐单孔腹腔镜胆囊切除术后切口感染预测模型的构建,对临床制定防治措施具有重要的意义。本研究以经脐单孔腹腔镜胆囊切除手术患者为对象,探讨经脐单孔腹腔镜胆囊切除术后切口感染的列线图模型预测价值及防治策略,报道如下。

1 资料与方法

1.1 临床资料

回顾性分析 2018 年 10 月 -2021 年 5 月入院合肥市第一人民医院收治的经脐单孔腹腔镜胆囊切除术患者 94 例的临床资料。纳入标准:(1)符合经脐单孔腹腔镜胆囊切除术治疗适应证^[7],且患者均可耐受;(2)患者术后完成相关检查,根据临床表现结合生化指标判断患者切口感染;(3)具有完整的基线资料。排除标准:(1)精神异常、胆囊急性炎症期者;(2)血液系统疾病、伴有自身免疫系统疾病或胆囊恶性肿瘤者;(3)严重肝肾功能异常者。根据患者术后是否发生切口感染分为感染组和非感染组。感染组 12 例,男 7 例,女 5 例,年龄 22-75 岁,平均(49.75±6.31)岁;体质指数(BMI)18-29 kg/m²,平均(23.51±4.39)kg/m²;合并症:高血压 2 例,糖尿病 2 例,高脂血症 2 例;患者手术时机:择期手术 8 例,急诊手术 4 例;非感染组 82 例,男 17 例,女 65 例,年龄 13-72 岁,平均(45.33±6.37)岁;BMI 17-30 kg/m²,平均(23.64±4.43)kg/m²;合并症:高血压 12 例,糖

尿病 2 例,高脂血症 5 例;患者手术时机:择期手术 44 例,急诊手术 38 例。

1.2 方法

(1)手术治疗方法:所有患者均采用经脐单孔腹腔镜胆囊切除术治疗,术前完善有关检查,制定详细的手术方案。常规完成术前准备,经气管插管全身麻醉,待麻醉生效后进行常规消毒、铺巾。在脐正中作长为 1.5-2 cm 纵向切口,帮助患者建立人工气腹,控制气腹压 12 mmHg。置入多个操作孔套管,借助腹腔镜的放大作用,进一步确定病灶部位。同时,利用腹腔镜进一步确定胆囊三角区,分离周围粘连的组织;常规解剖胆囊动脉与胆囊管,夹闭后切断,常规完成胆囊的剥离,对于未见胆漏、出血患者,在脐孔部位取胆囊送检,缝合手术切口,完成手术。(2)临床资料收集:查阅两组病历资料,记录两组性别、年龄、手术时机、手术时间、住院时间、胆囊破裂、医生经验(以施行手术 50 台为界限)、BMI 等。

1.3 统计分析

采用 SPSS24.0 软件处理,计数资料采用 n(%)表示,行 χ^2 检验,计量资料采用($\bar{x} \pm s$)表示,行 t 检验。多因素 Logistic 回归分析术后切口感染的影响因素,引入 R 软件建立经脐单孔腹腔镜胆囊切除术后切口感染预测模型并绘制列线图模型,绘制 ROC 曲线,分析列线图模型对术后切口感染的预测效能。 $P < 0.05$ 则差异有统计学意义。

2 结果

2.1 经脐单孔腹腔镜胆囊切除术后切口感染影响因素的单因素分析

94 例经脐单孔腹腔镜胆囊切除术患者中 12 例术后切口发生感染,感染率为 12.77%。单因素结果表明:经脐单孔腹腔镜胆囊切除术后切口感染发生率与性别、手术时机、医生经验、BMI、高血压史、糖尿病史、高脂血症史无关($P > 0.05$);与年龄、手术时间、住院时间、胆囊破裂有关($P < 0.05$),见表 1。

表 1 经脐单孔腹腔镜胆囊切除术后切口感染影响单因素分析[n(%)]

Table 1 Univariate analysis of incision infection after transumbilical single port laparoscopic cholecystectomy[n(%)]

Factors	n	Infection group (n=12)	Non-infection group(n=82)	χ^2	P
Age	≥ 35 years	10(83.33)	43(52.44)	4.063	0.044
	<35 years	2(16.67)	39(47.56)		
Gender	Male	7(58.33)	45(54.88)	0.051	0.822
	Female	5(41.67)	37(45.12)		
Operation opportunity	Elective operation	8(66.67)	44(53.66)	0.717	0.397
	Emergency operation	4(33.33)	38(46.34)		
Doctor experience	>50 sets	5(41.67)	46(56.10)	0.092	0.761
	≤ 50 sets	7(58.33)	36(43.90)		
Operation time	≥ 2 h	10(83.33)	15(18.29)	22.683	0.000
	<2 h	2(16.67)	67(81.71)		

续表 1 经脐单孔腹腔镜胆囊切除术后切口感染影响单因素分析[n(%)]

Table 1 Univariate analysis of incision infection after transumbilical single port laparoscopic cholecystectomy[n(%)]

Factors		n	Infection group (n=12)	Non-infection group(n=82)	χ^2	P
BMI	$\geq 25 \text{ kg/m}^2$	40	7(58.33)	33(40.24)	0.743	0.389
	$<25 \text{ kg/m}^2$	54	5(41.67)	49(59.76)		
Hospital stay	$\geq 7 \text{ d}$	22	8(66.67)	14(17.07)	14.362	0.000
	$<7 \text{ d}$	72	4(33.33)	68(82.93)		
Gallbladder rupture	Yes	28	9(75.00)	19(23.17)	9.995	0.000
	No	66	3(25.00)	63(76.83)		
Hypertension	Yes	6	1(8.33)	5(6.10)	2.435	0.119
	No	88	11(91.67)	77(93.90)		
Diabetes	Yes	9	1(8.33)	8(9.76)	3.781	0.052
	No	85	11(91.67)	74(90.24)		
Hyperlipidemia	Yes	7	1(8.33)	6(7.32)	1.697	0.193
	No	87	11(91.67)	76(92.68)		

2.2 经脐单孔腹腔镜胆囊切除术后切口感染影响因素的多因素 Logistic 回归分析

多因素 Logistic 回归分析结果表明:经脐单孔腹腔镜胆囊

切除术后切口感染的影响因素为年龄、手术时间、住院时间、胆囊破裂($P<0.05$),见表 2。

表 2 经脐单孔腹腔镜胆囊切除术后切口感染影响因素的多因素 Logistic 回归分析

Table 2 Multivariate Logistic regression analysis of influencing factors of incision infection after transumbilical single hole laparoscopic cholecystectomy

Factors	β	S.E	Wald	P	OR	95%CI
Age	1.973	0.121	9.434	0.000	7.982	6.313-8.493
Operation time	1.495	0.104	8.498	0.000	6.791	6.312-7.326
Hospital stay	1.213	0.097	7.151	0.000	5.457	4.698-7132
Gallbladder rupture	1.336	0.115	7.894	0.000	6.632	6.035-7.214

2.3 列线图预测模型的构建

利用 R 软件建立预测术后切口感染的列线图模型,根据列线图模型得出:总分年龄得分为 63 分,住院时间得分为 37.6 分,手术时间得分为 71.5 分,胆囊破裂得分为 50 分,预测风险值为 2.221,见图 1。

2.4 列线图模型对经脐单孔腹腔镜胆囊切除术后切口感染的预测效能

ROC 曲线结果表明:列线图模型预测经脐单孔腹腔镜胆囊切除术后切口感染 C-index 为 0.816,具有良好的区分度;曲线下面积为 0.832,95%CI 为 0.757-0.899,具有良好的预测效能,见图 2。

3 讨论

经脐单孔腹腔镜胆囊切除术是临床上常用的微创手术,借助腹腔镜的放大作用,能切除胆囊组织,利于患者恢复^[8-10]。但是,部分患者由于围术期操作不当、手术适应证的拓宽等,导致患者术后切口感染率较高^[11-13]。本研究中,94 例经脐单孔腹腔镜胆囊切除术患者中 12 例术后切口发生感染,感染率为 12.77%。多因素 Logistic 分析结果表明:经脐单孔腹腔镜胆囊

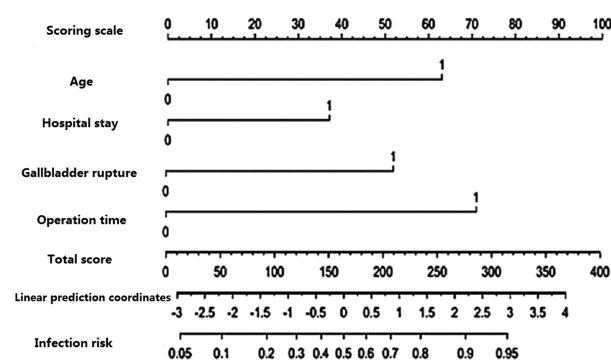


图 1 构建列线图预测模型

Fig.1 Construction of nomogram prediction model

Note: application method of nomograph prediction model: different variable values were taken on the score line at the top of the nomograph through the vertical line, get the corresponding value, add the scores of all variables to obtain the total score, and finally obtain the corresponding predicted risk value on the prediction line at the bottom of the nomograph through the total score line.

切除术后切口感染影响因素为年龄、手术时间、住院时间、胆囊破裂($P<0.05$),从本研究结果看出,经脐单孔腹腔镜胆囊切除

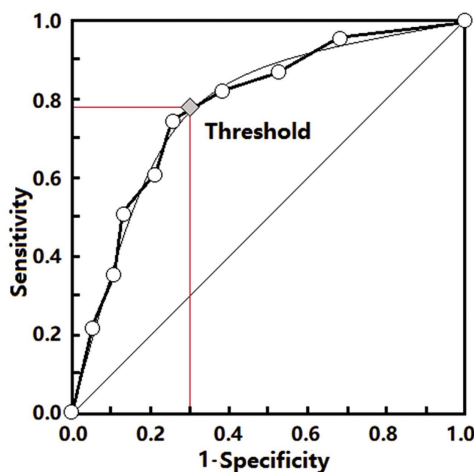


图2 列线图模型对经脐单孔腹腔镜胆囊切除术后切口感染的预测效能
Fig.2 Effectiveness of nomogram model in predicting incision infection after transumbilical single hole laparoscopic cholecystectomy

术后切口感染率较高,且受到的影响因素较多:(1)年龄:对于年龄较大患者,常伴有多种基础疾病,再加上机体器官出现衰退,抵抗力下降,围术期手术创伤及麻醉等,均会进一步削弱机体免疫,增加术后切口感染率^[14,15];(2)手术时间:通常来说,患者手术时间越长,切口部位暴露在空气中时间越长,术后感染率越高^[16]。国内学者研究表明^[17]:手术时间延长,能引起患者手术切口血流障碍加重,引起患者局部组织防御、修复能力降低;(3)住院时间:住院时间延长的患者多为创伤较大、一般状况差患者,患者全身及局部抵抗力降低,导致患者术后感染率较高^[18];(4)胆囊破裂:手术过程中,对于胆囊发生破裂患者,将会引起胆汁流入腹腔,引起周围组织及腹腔污染,增加患者术后感染率^[19,20]。

临床预测模型旨在分析个体对某种疾病的发生(诊断模型)或将要发生(预后模型)的绝对概率(或风险)的风险预测^[21,22]。危险因素预测模型多数为队列设计,常用预测模型为Framingham 风险评分,该模型能预测术后切口感染率^[23-25]。国内学者研究表明^[26]:借助列线图,能确定患者术后切口感染的可能危险因素,能为临床制定措施防治提供依据。本研究中,列线图模型得出预测风险值为2.221,ROC 曲线下面积为0.832,构建的经脐单孔腹腔镜胆囊切除术后切口感染模型具有良好的预测效果。

为了降低患者术后感染率,临床上应针对上述可能的因素,结合构建模型制定相应的措施进行防治:(1)在为患者制定手术方案时,应充分考虑患者的年龄,尤其是对于伴有基础疾病患者,重视患者基础疾病的治疗与控制;同时,术前完善有关检查,评估患者身体状态,了解患者的药物史、疾病史等,对患者的身体情况有全面的了解^[27];(2)尽可能由临床经验丰富的医生完成手术,避免医源性因素引起的术后切口感染,降低围术期胆囊破裂发生率;手术过程中严格遵循无菌操作,减少入侵时操作次数,避免发生交叉感染;(3)手术过程中尽可能缩短手术时间,减少手术切口在空气中的暴露;(4)加强患者术后并发病的观察:术后注意观察患者体温、心率的变化,及时复查血象。术后按时查看患者伤口情况,观察伤口敷料有无渗出及压痛,告知患者术后注意事项。(5)出院后定期到医院复查;加强

患者门诊随访、电话随访及上门随访,针对患者出现的问题,及时采取干预措施;(6)对于切口感染高危患者,可酌情使用抗生素预防感染;对于符合出院指征患者,根据围手术期快速康复理念,尽早安排患者出院,降低术后切口感染率^[28-30]。

综上所述,经脐单孔腹腔镜胆囊切除术后切口感染率较高,且受到的影响因素较多,基于上述影响因素构建的列线图预测模型具有良好的区分度,能获得较高的预测效能,值得推广应用。

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