·临床研究·

老年恶性梗阻性黄疸行经内镜逆行胰胆管造影胆道支架置入术治疗的疗效及影响因素分析

任宇,钱洁,刘佳,任秀国*,高颖新
(首都医科大学附属北京朝阳医院消化内科,北京 100020)

【摘 要】 **目的** 探讨老年恶性梗阻性黄疸患者行经内镜逆行胰胆管造影(ERCP)胆道支架置入术治疗的疗效,并分析其影响因素。**方法** 收集2023年3月至2025年4月首都医科大学附属北京朝阳医院收治的132例行ERCP胆道支架置入术治疗的老年恶性梗阻性黄疸患者的临床资料。以术后3 d总胆红素较术前降低≤30%或升高为疗效不良,将132例患者分为疗效良好组与疗效不良组。比较两组患者术前外周血T细胞抗原受体(TCR)Shannon熵指数、前白蛋白(PA)、肝脏储备功能[吲哚菁绿15 min滞留率(ICGR15)]等一般资料。采用SPSS 25.0统计软件进行数据分析。组间比较分别采用t检验或χ^2检验。采用多因素条件logistic逐步回归分析评估老年恶性梗阻性黄疸患者ERCP胆道支架置入术后早期疗效不良的影响因素。采用Kaplan-Meier法绘制生存曲线,组间生存差异比较采用log-rank检验。**结果** 132例老年恶性梗阻性黄疸患者术前总胆红素为(245.58±21.63)μmol/L,术后3 d为(151.82±19.35)μmol/L,其中总胆红素较术前下降幅度≤30%者37例、升高者4例,共41例(31.06%)疗效不良者纳入疗效不良组,其余91例纳入疗效良好组。疗效不良组术中胆管扩张率以及术前TCR Shannon熵指数、PA均低于疗效良好组,术前ICGR15高于疗效良好组,差异均有统计学意义(P<0.05)。多因素条件logistic逐步回归分析显示,术前ICGR15为老年恶性梗阻性黄疸患者ERCP胆道支架置入术术后早期疗效不良的危险因素(OR=5.463,95%CI 3.537~8.439;P<0.05),术中胆管扩张(OR=0.375,95%CI 0.163~0.644;P<0.05)及术前TCR Shannon熵指数(OR=0.240,95%CI 0.104~0.613;P<0.05)、术前PA(OR=0.359,95%CI 0.156~0.632;P<0.05)则为其保护因素。以术后6个月为终点,疗效不良组与疗效良好组分别有11例(26.83%)和10例(10.99%)患者死亡,疗效不良组的生存期均值显著低于疗效良好组[5.34个月(95%CI 4.967~5.716)和5.80个月(95%CI 5.676~5.929);P=0.015]。**结论** 老年恶性梗阻性黄疸患者ERCP胆道支架置入术后,早期疗效不佳者并不少见;术前低ICGR15、高TCR多样性、高PA以及术中胆管扩张操作可促进术后早期总胆红素下降。

【关键词】 老年人;恶性梗阻性黄疸;经内镜逆行胰胆管造影;胆道支架置入术;疗效;因素
【中图分类号】 R575.7 【文献标志码】 A 【DOI】 10.11915/j.issn.1671-5403.2026.10.146

Efficacy and influencing factors of endoscopic retrograde cholangiopancreatography with biliary stent implantation in the treatment of elderly patients with malignant obstructive jaundice

Ren Yu, Qian Jie, Liu Jia, Ren Xiuguo*, Gao Yingxin
(Department of Gastroenterology, Beijing Chaoyang Hospital, Capital Medical University, Beijing 100020, China)

【Abstract】 **Objective** To investigate the efficacy of endoscopic retrograde cholangiopancreatography (ERCP) with biliary stent implantation in the treatment of elderly patients with malignant obstructive jaundice, and to analyze its influencing factors. **Methods** Clinical data of 132 elderly patients with malignant obstructive jaundice who received ERCP with biliary stent implantation in our hospital from March 2023 to April 2025 were collected. Postoperative efficacy was defined as poor when total bilirubin was decreased by ≤30% or increased at 3 d after surgery compared with preoperative level. The 132 patients were divided into a good efficacy group and a poor efficacy group. General data including preoperative peripheral blood T cell receptor (TCR) Shannon entropy index, prealbumin(PA), liver reserve function [indocyanine green retention rate at 15 min (ICGR15)] were compared between the 2 groups. SPSS 25.0 statistics was used for data processing, and t test or *Chi*-square test was applied for intergroup comparison. Multivariate stepwise conditional logistic regression analysis was employed to identify the influencing factors for early poor efficacy after ERCP with biliary stent implantation in elderly patients with malignant obstructive jaundice. Survival curve was drawn by Kaplan-Meier survival analysis, and the survival difference was compared between groups by Log-rank test. **Results** The total bilirubin level was (245.58±21.63) μmol/L before surgery and (151.82±19.35)

收稿日期: 2025-10-27; **接受日期**: 2025-12-15
基金项目: 首都卫生发展科研专项(2022-4-20313)
通信作者: 任秀国, E-mail: renxiuguo@sohu.com

μmol/L at 3 d after surgery in the 132 patients. There were 37 patients with a decrease of ≤ 30% and 4 patients with an increase in total bilirubin compared to preoperative levels. A total of 41 patients (31.06%) with poor efficacy were included in the poor efficacy group, and the remaining 91 patients were included in the good efficacy group. The poor efficacy group exhibited significantly lower intraoperative bile duct dilatation rate, preoperative TCR Shannon entropy index and PA, and higher preoperative ICGR15 compared with the good efficacy group (P<0.05). Multivariate stepwise conditional logistic regression analysis revealed that preoperative ICGR15 (OR=5.463, 95%CI 3.537-8.439; P<0.05) was a risk factor for early poor efficacy in elderly patients with malignant obstructive jaundice after ERCP with biliary stent implantation, and intraoperative bile duct dilatation(OR=0.375, 95%CI 0.163-0.644; P<0.05), preoperative TCR Shannon entropy index (OR=0.240, 95%CI 0.104-0.613; P<0.05) and preoperative PA (OR=0.359, 95%CI 0.156-0.632; P<0.05) were protective factors. With 6 months after surgery as the endpoint, 11 patients (26.83%) in the poor efficacy group and 10 patients (10.99%) in the good efficacy group died. The mean survival time was significantly shorter in the poor efficacy group than the good efficacy group [5.34 months (95%CI 4.967-5.716) *vs* 5.80 months (95%CI 5.676-5.929); P=0.015]. **Conclusion** Early poor efficacy is not uncommon after ERCP with biliary stent implantation in elderly patients with malignant obstructive jaundice. Low preoperative ICGR15, high TCR diversity, high PA and intraoperative bile duct dilatation may promote the early postoperative total bilirubin decline.

【Key words】 aged; malignant obstructive jaundice; endoscopic retrograde cholangiopancreatography; biliary stent implantation; efficacy; factors

This work was supported by the Special Project of Capital Health Development Research (2022-4-201313).

Corresponding author: *Ren Xiuguo*, *E-mail*: *renxiuguo@sohu.com*

恶性梗阻性黄疸主要因原发性胰腺癌、胆总管癌等梗阻引起,部分患者可因卵巢癌、胃癌等转移性肿瘤梗阻引起,老年人为主要患病群体[1]。恶性梗阻性黄疸主要临床表现为腹痛、黄疸、肝功能异常等,由于缺乏特异性表现,早期不易被发现,常错失根治性手术时机,加之老年患者身体素质差,手术耐受性不高,根治性手术疗效及患者预后并不理想[2]。经内镜逆行胰胆管造影(endoscopic retrograde cholangiopancreatography, ERCP)胆道支架置入术创伤小,能缓解胆道梗阻,在改善恶性梗阻性黄疸患者生存质量方面具有优势[3]。作为姑息性治疗手段,ERCP 胆道支架置入术也存在失败风险,部分患者梗阻严重难以成功置入支架;部分患者即便置入支架,术后仍会出现胆道引流无效、短期减黄效果不明显、胆红素持续累积,导致患者死亡风险升高[4]。然而,目前恶性梗阻性黄疸 ERCP 胆道支架置入术后减黄效果不佳的影响因素尚存在争议,有报道指出,高位梗阻及塑料支架可能是手术治疗失败的高危因素,但也有报道认为 ERCP 胆道支架置入术后胆红素下降不理想的关键因素为肝脏储备功能差[5,6]。基于此,本研究分析老年恶性梗阻性黄疸患者 ERCP 胆道支架置入术后疗效不良的影响因素,以期为疾病围术期管理提供参考依据。

1 对象与方法

1.1 研究对象

选取 2023 年 3 月至 2025 年 4 月首都医科大学附属北京朝阳医院收治的 132 例老年恶性梗阻性黄疸患者为研究对象。纳入标准:恶性梗阻性黄疸诊断符合《急性胆道系统感染的诊断和治疗指南(2021 版)》中诊断标准[7];年龄≥60 岁;首次行 ERCP 胆道支架置入术治疗,且支架成功置入;实验室检查等资料完整。排除标准:既往胆道、肝脏手术史;合并胆总管结石等导致梗阻性黄疸的其他疾病;合并精神疾病或意识障碍;合并心脑血管疾病;合并多器官功能衰竭;碘过敏。本研究方案经首都医科大学附属北京朝阳医院伦理委员会批准(批准文号:2023-科-135)。所有受试者均在参与研究前签署书面知情同意书。研究符合《赫尔辛基宣言》。

1.2 方法

1.2.1 治疗 所有入组的老年恶性梗阻性黄疸患者均由同一组医师完成 ERCP 胆道支架置入术治疗。患者取俯卧位下不插管全身麻醉,将十二指肠镜(美国 OLYMPUS 公司,型号:290SL)经口进入十二指肠降段大乳头处,在乳头开口处导丝(美国 Boston Scientific Corporation,型号:M00556581)逆行插管进入胆总管,注入 10 ml 碘海醇,显影梗阻部位,导丝头端置入狭窄段以远确定预定支架位置,主刀医师根据梗阻程度选择是否在置入支架前行狭窄部位球囊扩张,使用推送器沿导丝将支架置入预定胆道部位,确定支架固定后撤出导丝,退镜后胆汁流入十二指肠且术后拍摄腹部平片显示支架固定在位提示支架放置成功;术后给予禁食、质子泵抑制剂、抗感染等常规治疗,并给予 6 mg 生长抑素微量泵泵入。

1.2.2 疗效评估与分组 参考日本学者 Kanno 等[8]的疗效判断方法,以术后 3d 总胆红素较术前降低≤30%或升高为疗效不良,将患者分为疗效良好组与疗效不良组。

1.2.3 资料收集 在获得患者知情同意后,经住院电子病历系统查阅患者一般资料,包括合并症、病因、术前实验室指标、肝脏储备功能等。其中,合并症使用年龄校正的 Charlson 共病指数[9]评估,最高

分为38分,得分越高提示共病越严重。实验室指标包括T细胞抗原受体(T cell receptor, TCR)、Shannon熵指数、前白蛋白(prealbumin, PA)、白蛋白、总胆红素、丙氨酸氨基转移酶、门冬氨酸氨基转移酶、碱性磷酸酶,样本均来自手术当日清晨空腹外周肘静脉血,使用D Neasy Blood Kit试剂盒(德国QIAGEN公司)提取外周血基因组脱氧核糖核酸,使用荧光定量仪(美国THERMO公司,型号:Qubit 3.0)筛选脱氧核糖核酸≥500 ng的样本进入建库流程,多重聚合酶链式反应技术扩增,并在扩增产物末端连接测序接头完成建库,使用repExplore函数比较不同长度TCR第三互补决定区氨基酸序列分布克隆型数目,使用repDiversity函数计算Shannon熵指数,数值越高,TCR多样性越高;PA等实验室指标使用全自动生化分析仪(日本Hitachi公司,型号:7600-220)检测。肝脏储备功能采用吲哚菁绿15 min滞留率(indocyanine green retention rate at 15 minutes, ICGR15)评估,使用注射用吲哚菁绿(丹东医创药业有限责任公司,H20055881,25 mg),注射剂量为0.5 mg/kg(体质量),根据肝脏储备分析仪(日本Nihon Solar Tech Limited公司,型号:DDG-3300K)指示,在10 s内由肘中静脉注入吲哚菁绿,记录仪器输出的测试结果,整个测试完成需要6 min。使用老年营养风险指数(geriatric nutritional risk index, GNRI)评估老年恶性梗阻性黄疸患者营养状况,GNRI =1.489×血清白蛋白(g/L)+41.7×实际体质量(kg)/理想体质量(kg)[10],得分越低提示营养状况越差。

1.2.4 术后并发症 记录ERCP胆道支架置入术后并发症,其常见并发症包括急性胰腺炎、出血、消化道穿孔、胆道感染、支架堵塞等。

1.2.5 随访 采用门诊复查、电话及入户随访的方式对老年恶性梗阻性黄疸患者跟踪随访,虽然本研究为回顾性研究,部分患者长期随访资料丢失,但入组的132例患者术后6个月内的随访资料均保留完好,故以术后6个月为终点,分析比较两组术后生存期。

1.3 统计学处理

采用SPSS 25.0统计软件进行数据分析。计量资料中呈正态分布者以均数±标准差($\bar{x}\pm s$)表示,组间比较采用t检验;计数资料以例数(百分率)表示,组间比较采用χ^2检验。采用多因素logistic回归分析(逐步条件回归)评估老年恶性梗阻性黄疸患者ERCP胆道支架置入术后早期疗效不良的影响因素。采用Kaplan-Meier法绘制生存曲线,组间生存差异比较采用log-rank检验。$P<0.05$为差异有统计学意义。

2 结 果

2.1 ERCP胆道支架置入术早期疗效分析

132例老年恶性梗阻性黄疸患者术前总胆红素均值为(245.58±21.63)μmol/L,术后3d为(151.82±19.35)μmol/L。其中总胆红素较术前下降幅度≤30%者37例、升高者4例,共41例(31.06%)疗效不良患者纳入疗效不良组,其余91例纳入疗效良好组。

2.2 两组患者一般资料

疗效不良组术中胆管扩张率、术前TCR Shannon熵指数、PA均低于疗效良好组,术前ICGR15高于疗效良好组,差异均有统计学意义($P<0.05$;表1)。

2.3 ERCP胆道支架置入术后早期疗效不良的影响因素分析

以术后3 d疗效为因变量(疗效良好=0,疗效不良=1),表1中$P<0.05$的指标为自变量赋值(术中胆管扩张:有=1,无=0;术前TCR Shannon熵指数、PA及ICGR15均为实测值),行多因素条件logistic逐步回归分析,结果显示:术前ICGR15为老年恶性梗阻性黄疸患者ERCP胆道支架置入术术后早期疗效不良的危险因素($P<0.05$),术中胆管扩张、术前TCR Shannon熵指数、PA均为其保护因素($P<0.05$;表2)。

2.4 两组患者术后生存期分析

以术后6个月为终点,疗效不良组与疗效良好组分别有11例(26.83%)、10例(10.99%)患者死亡。两组Kaplan-Meier曲线分析显示,疗效不良组的生存期均值为5.34个月(95%*CI* 4.967~5.716),显著低于疗效良好组的5.80个月(95%*CI* 5.676~5.929),差异有统计学意义(log-rank $\chi^2=5.865$, $P=0.015$;图1)。

3 讨 论

胆道梗阻会导致肝脏血流量减少、肝功能受损,同时削弱Kupffer细胞清除能力,致使内毒素进入循环血液;且胆道压力升高可引起胆汁反流入血,从而诱导大量炎症因子产生,引起全身性炎症反应综合征,最终造成多器官功能障碍甚至衰竭,故及时解除胆道梗阻是改善恶性梗阻性黄疸患者预后的关键[11]。据报道,恶性梗阻性黄疸患者中只有20%符合根治性手术治疗条件,目前无法行根治术治疗的患者常采用姑息性胆道引流术,以延长生存期[12]。ERCP胆道支架置入术经内镜安装支架,将胆汁引流

表 1 两组患者一般资料比较

Table 1 Comparison of general data between two groups

Item	Poor efficacy group(n=41)	Good efficacy group(n=91)	χ^2/t	P value
Male[n(%)]	23(56.10)	49(53.85)	0.058	0.810
Age(years, $\bar{x}\pm s$)	72.45±5.17	70.98±4.91	1.566	0.120
Body mass index(kg/m^2, $\bar{x}\pm s$)	21.12±2.08	21.63±2.17	1.265	0.208
Hypertension[n(%)]	9(21.95)	18(19.78)	0.082	0.775
Diabetes mellitus[n(%)]	5(12.20)	8(8.79)	0.085	0.771*
Coronary heart disease[n(%)]	4(9.76)	8(8.79)	0.022	0.882*
aCCI($\bar{x}\pm s$)	5.65±1.35	5.39±1.16	1.132	0.260
Etiology[n(%)]			0.366	0.833
Pancreatic cancer	12(29.27)	31(34.07)		
Cholangiocarcinoma	21(51.22)	45(49.45)		
Duodenal papillary carcinoma	8(19.51)	15(16.48)		
Obstruction time(d, $\bar{x}\pm s$)	22.04±4.19	23.45±4.35	1.743	0.084
Obstruction site[n(%)]			2.839	0.092
High	12(29.27)	15(16.48)		
Low	29(70.73)	76(83.52)		
Bile duct diameter(mm, $\bar{x}\pm s$)	16.69±3.04	15.89±2.98	1.418	0.159
Surgical time(min, $\bar{x}\pm s$)	28.98±4.18	28.45±4.36	0.654	0.514
Intraoperative blood loss volume(ml, $\bar{x}\pm s$)	79.65±8.49	77.95±6.35	1.277	0.204
Postoperative sphincterotomy[n(%)]	24(58.54)	41(45.05)	2.055	0.152
Intraoperative bile duct dilatation[n(%)]	6(14.63)	29(31.87)	4.309	0.038
Stent type[n(%)]			1.449	0.229
Metal stent	29(70.73)	73(80.22)		
Plastic stent	12(29.27)	18(19.78)		
Preoperative laboratory indicator($\bar{x}\pm s$)				
TCR Shannon entropy index	7.25±1.36	8.93±1.48	6.185	<0.001
PA(mg/L)	150.49±25.78	198.36±28.17	9.269	<0.001
Albumin(g/L)	36.59±5.44	38.20±6.38	1.402	0.163
Total bilirubin(μmol/L)	249.12±22.85	243.98±20.21	1.298	0.197
Alanine aminotransferase(U/L)	85.54±13.27	81.45±12.69	1.689	0.094
Aspartate aminotransferase(U/L)	73.02±13.24	69.29±11.63	1.632	0.105
Alkaline phosphatase(U/L)	271.49±21.55	264.83±22.98	1.570	0.119
ICGR15(%)	15.24±2.89	13.11±2.47	4.345	<0.001
GNRI($\bar{x}\pm s$)	95.86±3.57	96.37±3.15	0.825	0.411
Postoperative complication[n(%)]				
Acute pancreatitis	2(4.88)	2(2.20)	0.080	0.777*
Bleeding	4(9.76)	6(6.59)	0.078	0.779*
Biliary tract infection	2(4.88)	2(2.20)	0.080	0.777*

aCCI: age-adjusted Charlson comorbidity index; TCR: T cell receptor; PA: prealbumin; ICGR15: indocyanine green retention rate at 15 minutes; GNRI: geriatric nutritional risk index. * Continuous correction *Chi*-square test.

表 2 ERCP 胆道支架置入术后早期疗效不良的多因素条件 logistic 逐步回归分析

Table 2 Multivariate logistic stepwise regression analysis of early poor efficacy after ERCP biliary stent implantation

Factor	β	SE	$Wald\ \chi^2$	P value	OR	95%CI
Intraoperative bile duct dilatation	−0.981	0.369	7.068	0.008	0.375	0.163−0.644
Preoperative TCR Shannon entropy index	−1.427	0.409	12.173	<0.001	0.240	0.104−0.613
Preoperative PA	−1.024	0.371	7.618	0.006	0.359	0.156−0.632
Preoperative ICGR15	1.698	0.412	16.986	<0.001	5.463	3.537−8.439

ERCP: endoscopic retrograde cholangiopancreatography; TCR: T cell receptor; PA: prealbumin; ICGR15: indocyanine green retention rate at 15 minutes.

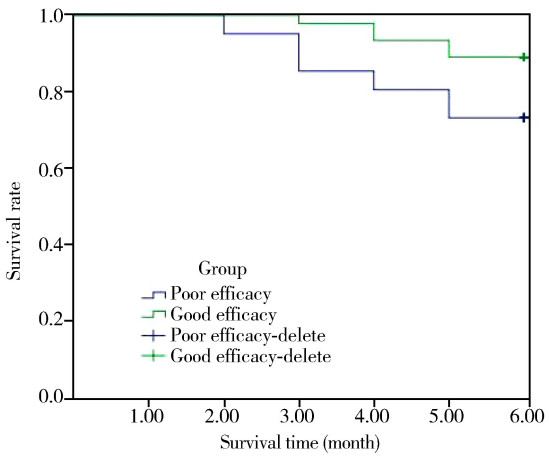


图 1 两组患者生存期 Kaplan-Meier 曲线分析

Figure 1 Kaplan-Meier curve analysis of survival time in two groups

入十二指肠,从而缓解临床症状,且具有创伤小、并发症少等优点,对身体素质较差的老年患者也适用,在临床应用广泛[13]。然而,临床实际应用发现,部分患者 ERCP 胆道支架置入术后减黄效果欠佳,甚至出现胆红素不降反升现象,导致预后生存期缩短[14]。本研究分析老年恶性梗阻性黄疸患者 ERCP 胆道支架置入术后 3 d 临床疗效,发现有 31.06%患者出现疗效不良,提示 ERCP 胆道支架置入术后早期减黄效果不理想者并不少见。分析患者术后 6 个月生存情况还发现,疗效不良组的生存期显著低于疗效良好组,提示 ERCP 胆道支架置入术后疗效不佳可能导致老年恶性梗阻性黄疸患者预后生存时间缩短,与以往报道相似[14]。因此,临床应积极识别术后疗效不佳高风险患者,及时调整临床决策,以尽可能地改善患者预后生存情况。

肝脏储备功能可应对机体免疫、解毒等功能性需求,还可满足肝组织修复、再生需求,但胆汁淤积、反流可引起肝组织受损,使肝脏储备功能降低,加重黄疸症状[15]。本研究中,疗效不良组术前 ICGR15 高于疗效良好组,且回归分析显示,术前 ICGR15 是老年恶性梗阻性黄疸患者 ERCP 胆道支架置入术后早期疗效不良的危险因素,提示肝脏储备功能下降是导致疗效不佳的重要原因。分析其原因可能为肝脏储备功能受损可影响肝脏对胆红素的生成及排泄功能,导致术后胆红素持续堆积,支架引流术后早期总胆红素水平未能大幅度下降[16]。另外,营养状态也是影响恶性肿瘤手术疗效及患者预后的关键因素,PA 较白蛋白半衰期短,可敏感地反映机体营养及肝脏合成功能,近年被发现可预测胰腺癌、肝癌等恶性肿瘤患者的预后状况[17]。本研究也发现,术前 PA 是老年恶性梗阻性黄疸患者术后早期疗效不良的保护因素。究其原因可能为 PA 主要由肝脏合成,术前较高水平的 PA 提示肝脏储备功能未受到严重损伤,胆红素代谢未严重受限,经 ERCP 胆道支架置入术引流后,可促进肠肝循环,缓解胆红素堆积[18]。

另据文献报道,抗肿瘤免疫应答的关键在于 TCR 介导的抗原特异性免疫应答。T 细胞通过 TCR 识别恶性肿瘤抗原后,出现特异性激活并扩增,使 TCR 免疫组库呈现异质性分布[19,20]。TCR 免疫组库特征也是近年国内外研究的热点。目前认为,TCR 组库多样性与肿瘤负荷及免疫治疗预后密切相关,机体遭到肿瘤抗原刺激时可诱导 T 细胞出现单克隆或寡克隆反应性增生,导致 TCR 某一序列克隆比例显著升高,而多样性下降。还有报道指出,TCR 多样性越高提示机体抗肿瘤能力越强,患者预后更好[21]。本研究中,术前 TCR Shannon 熵指数是 ERCP 胆道支架置入术后早期疗效不良的保护因素,提示 TCR 多样性越高者 ERCP 胆道支架置入术减黄效果越好,其原因可能为 TCR 多样性高意味着机体抗肿瘤能力强,可有效限制肿瘤的侵犯范围、降低置管操作难度,因此患者术后减黄效果更佳[22]。然而,本研究 TCR 多样性评估是利用 TCR 第三互补决定区序列信息及 repExplore 等函数计算,可能未能精确还原生物原始序列信息,未来还需借助更高效的检测手段或计算方法提升 TCR 多样性评估的精确性,并结合多中心大样本量临床试验验证上述结果的准确性。此外,本研究还发现,术中胆管扩张也是术后早期疗效不良的保护因素。肿瘤浸润、胆泥堆积会引起操作难度增大,导致 ERCP 胆道支架置入术引流效果不佳。而术中行胆管扩张,可辅助支架顺利安置,避免反复操作造成的胆道损伤,从而促进胆道引流,提高疗效[23]。

综上,老年恶性梗阻性黄疸患者 ERCP 胆道支架置入术后早期减黄效果不理想者较多,值得临床重点关注。术前 TCR 多样性较高、PA 较高以及行术中胆管扩张者,术后早期疗效不佳的发生风险更低;而肝脏储备功能下降则会导致该不良结局的发生风险升高。

【参考文献】

[1] Zerem E, Imširović B, Kunosić S, *et al*. Percutaneous biliary drainage for obstructive jaundice in patients with inoperable, malignant biliary obstruction[J]. Clin Exp Hepatol, 2022, 8(1): 70-77. DOI: 10.5114/ceh.2022.114190.

[2] Kang LM, Xu L, Yu FK, *et al*. Advances in minimally invasive treatment of malignant obstructive jaundice[J]. World J Gastrointest Surg, 2024, 16(12): 3650-3654. DOI: 10.4240/wjgs.v16.i12.3650.

[3] Cai Y, Fan Z, Yang G, *et al*. Analysis of the efficacy of percutaneous transhepatic cholangiography drainage (PTCD) and endoscopic retrograde cholangiopancreatography (ERCP) in the treatment of malignant obstructive jaundice (MOJ) in palliative drainage and preoperative biliary drainage: a single-center retrospective study[J]. BMC Surg, 2024, 24(1): 307-316. DOI: 10.1186/s12893-024-02595-w.

[4] Isayama H, Hamada T, Fujisawa T, *et al*. TOKYO criteria 2024 for the assessment of clinical outcomes of endoscopic biliary drainage[J]. Dig Endosc, 2024, 36(11): 1195-1210. DOI: 10.1111/den.14825.

[5] Teoh AYB, Napoleon B, Kunda R, *et al*. EUS-guided choledochoduodenostomy using lumen apposing stent *versus* ERCP with covered metallic stents in patients with unresectable malignant distal biliary obstruction: a multicenter randomized controlled trial (DRA-MBO Trial)[J]. Gastroenterology, 2023, 165(2): 473-482.e2. DOI: 10.1053/j.gastro.2023.04.016.

[6] Xing Y, Liu ZR, Li YG, *et al*. Efficacy and safety of percutaneous transhepatic biliary radiofrequency ablation in patients with malignant obstructive jaundice[J]. World J Clin Cases, 2024, 12(17): 2983-2988. DOI: 10.12998/wjcc.v12.i17.2983.

[7] 中华医学会外科学分会胆道外科学组. 急性胆道系统感染的诊断和治疗指南(2021 版)[J]. 中华外科杂志, 2021, 59(6): 422-429. DOI: 10.3760/cma.j.cn112139-20210421-00180.

[8] Kanno Y, Ito K, Nakahara K, *et al*. Suprapapillary placement of plastic *versus* metal stents for malignant biliary hilar obstructions: a multicenter, randomized trial[J]. Gastrointest Endosc, 2023, 98(2): 211-221. DOI: 10.1016/j.gie.2023.03.007.

[9] Zhang N, Lin Q, Jiang H, *et al*. Age-adjusted Charlson comorbidity index as effective predictor for in-hospital mortality of patients with cardiac arrest: a retrospective study[J]. BMC Emerg Med, 2023, 23(1): 7-10. DOI: 10.1186/s12873-022-00769-4.

[10] Li H, Cen K, Sun W, *et al*. Prognostic value of geriatric nutritional risk index in elderly patients with heart failure: a meta-analysis[J]. Aging Clin Exp Res, 2021, 33(6): 1477-1486. DOI: 10.1007/s40520-020-01656-3.

[11] Isram J, Haider E, Khan RSA, *et al*. Diagnostic accuracy of magnetic resonance cholangiopancreatography in comparison with endoscopic retrograde cholangiopancreatography for detection of the etiology of obstructive jaundice[J]. Cureus, 2023, 15(2): e34484. DOI: 10.7759/cureus.34484.

[12] Sun P, Zhong Y, Hu Y, *et al*. Preoperative biliary drainage for patients with malignant obstructive jaundice: an update on the systematic review and model-based Bayesian network meta-analysis[J]. Int J Surg, 2025, 111(8): 5475-5484. DOI: 10.1097/JS9.0000000000002559.

[13] Mukai S, Itoi T. Preoperative endoscopic ultrasound-guided biliary drainage for primary drainage in obstructive jaundice[J]. Expert Rev Gastroenterol Hepatol, 2023, 17(12): 1197-1204. DOI: 10.1080/17474124.2023.2293813.

[14] Debourdeau A, Daniel J, Caillo L, *et al*. Effectiveness of endoscopic ultrasound (EUS)-guided choledochoduodenostomy *vs*. EUS-guided gallbladder drainage for jaundice in patients with malignant distal biliary obstruction after failed endoscopic retrograde cholangiopancreatography: retrospective, multicenter study (GALLBLADEUS Study)[J]. Dig Endosc, 2025, 37(1): 103-114. DOI: 10.1111/den.14750.

[15] Ai X, Wang H, Yang Y, *et al*. Four indices on Gd-EOB-DTPA-enhanced MRI can estimate liver functional reserve compared to ICG-R15: a systematic review and meta-analysis[J]. Clin Imaging, 2023, 102(1): 1-8. DOI: 10.1016/j.clinimag.2023.06.018.

[16] 戴明, 杨欢欢, 杨泽帅. 老年原发性肝癌介入手术后胆汁瘤发生的危险因素[J]. 中华老年多器官疾病杂志, 2025, 24(4): 281-285. DOI: 10.11915/j.issn.1671-5403.2025.04.058.

[17] Matsumoto Y, Otsuka Y, Hosaka H, *et al*. Low prealbumin level is a poor prognostic biomarker for surgically treated pancreatic cancer[J]. Mol Clin Oncol, 2025, 23(1): 61-69. DOI: 10.3892/mco.2025.2856.

[18] Utakata Y, Miwa T, Hanai T, *et al*. Usefulness of retinol-binding protein in predicting mortality in patients with chronic liver disease[J]. JGH Open, 2025, 9(2): e70087. DOI: 10.1002/jgh3.70087.

[19] 谭琴, 马洁. 老年非小细胞肺癌肿瘤组织, 恶性胸腔积液与外周血 T 细胞受体免疫组库图谱[J]. 中华老年医学杂志, 2025, 44(7): 917-924. DOI: 10.3760/cma.j.issn.0254-9026.2025.07.012.

[20] Genolet R, Bobisse S, Chiffelle J, *et al*. TCR sequencing and cloning methods for repertoire analysis and isolation of tumor-reactive TCRs[J]. Cell Rep Methods, 2023, 3(4): e100459. DOI: 10.1016/j.crmeth.2023.100459.

[21] McCarthy EE, Yu S, Perlmutter N, *et al*. Endogenous antigens shape the transcriptome and TCR repertoire in an autoimmune arthritis model[J]. J Clin Invest, 2024, 135(2): e174647. DOI: 10.1172/JCI174647.

[22] Aburajab R, Pospiech M, Alachkar H. Profiling the epigenetic landscape of the antigen receptor repertoire: the missing epi-immunogenomics data[J]. Nat Methods, 2023, 20(4): 477-481. DOI: 10.1038/s41592-022-01723-9.

[23] 范玲, 刘懿, 孙正豪, 等. 早期经胰管括约肌预切开术在导丝误入胰管的内镜逆行胰胆管造影术困难插管中的临床应用[J]. 中华消化内镜杂志, 2024, 41(3): 212-217. DOI: 10.3760/cma.j.cn321463-20230820-00560.

(编辑: 和雨璇)