

一期 Duckett 与分期 Bracka 尿道成形术治疗非远端型尿道下裂术后并发症的 Meta 分析



全文二维码

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杨珍珍和李佳义对本文有同等贡献

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【摘要】 目的 评价并比较一期 Duckett 与分期 Bracka 尿道成形术治疗非远端型尿道下裂的临床疗效。**方法** 检索 PubMed、Embase、Web of science、Cochrane 图书馆、中国知网、万方和维普数据库中关于一期 Duckett 与分期 Bracka 尿道成形术治疗非远端型尿道下裂的随机或非随机对照试验、队列研究和病例对照研究, 检索文献时限为数据库建库至 2022 年 3 月 28 日。结局指标包括术后总体并发症和独立并发症(尿道瘘、尿道狭窄、尿道憩室、伤口裂开及移植相关并发症)情况及手术次数。应用 RevMan 5.4 进行 Meta 分析。**结果** 本研究共纳入 41 篇文献共 3 713 例患儿, 其中 2 395 例接受一期 Duckett 尿道成形术, 1 318 例接受分期 Bracka 尿道成形术。Meta 分析结果显示, 一期 Duckett 尿道成形术较分期 Bracka 尿道成形术, 术后尿道瘘($RD = 0.17$ 和 $RD = 0.10, P < 0.05$)、尿道狭窄($RD = 0.10$ 与 $RD = 0.03, P < 0.05$)及尿道憩室($RD = 0.04$ 与 $RD = 0.02, P < 0.05$)的发生率均更高, 差异均有统计学意义。5 篇关于两种术式对比研究的 Meta 分析结果显示, 一期 Duckett 尿道成形术后总并发症发生率高于分期 Bracka 尿道成形术($OR = 2.63, 95\% CI: 1.54 \sim 4.50, P < 0.05$)。一期 Duckett 尿道成形术与分期 Bracka 尿道成形术平均手术次数分别为 1.29 次和 2.15 次。**结论** 一期 Duckett 尿道成形术后并发症总发生率, 尿道瘘、尿道狭窄及尿道憩室发生率高于分期 Bracka 尿道成形术; 分期 Bracka 尿道成形术后移植相关并发症发生率为 5%。一期 Duckett 尿道成形术治愈非远端型尿道下裂所需手术次数更少。

【关键词】 尿道下裂; 外科手术; 手术后并发症; Meta 分析

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Efficacy of one-stage Duckett versus staged Bracka urethroplasty for nondistal hypospadias: a meta-analysis

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【Abstract】 Objective To review the currently available data and evaluate the efficacy of one-stage Duckett versus staged Bracka urethroplasty for non-distal hypospadias through Meta-analysis. **Methods** The database of PubMed, Embase, Web of Science, Cochrane Library, CNKI, Wanfang and VIP were searched for randomized or non-randomized controlled trials, cohort studies and case-control studies of one-stage Duckett versus staged Bracka urethroplasty for non-distal hypospadias. The measurement parameters included overall postoperative complications and individual complications (urethral fistula, urethral stricture, urethral diverticulum, wound dehiscence & graft-related complications). Meta-analysis was performed with RevMan 5.4 software. **Results** A total of 3 713 children were collected from 41 articles examining the effectiveness of one-stage Duckett urethroplasty ($n = 2 395$) versus staged Bracka urethroplasty ($n = 1 318$) were included for Meta-analysis. Meta-analysis results indicated that marked inter-group differences existed in occurrence rate of postoperative urethral fistula ($RD = 0.17$ and $RD = 0.10, P < 0.05$), occurrence rate of urethral stricture ($RD = 0.10$ and $RD = 0.03, P < 0.05$), occurrence rate of diverticula ($RD = 0.04$ and $RD = 0.02, P < 0.05$) and occurrence rate of

postoperative wound dehiscence ($RD = 0.02$ and $RD = 0.04, P < 0.05$). Meta-analysis results of 5 comparative studies showed that total complication rate after one-stage Duckett urethroplasty was higher than that of staged Bracka ($OR = 2.63, 95\% CI: 1.54 - 4.50, P < 0.05$). Operative frequency of one-stage Duckett urethroplasty and staged Bracka urethroplasty were 1.29 and 2.15 respectively. **Conclusion** The occurrence rate of total complications, urethral fistula, urethral stricture and urethral diverticulum after one-stage Duckett urethroplasty was higher than that of staged Bracka. Graft-related complication rate after staged Bracka urethroplasty is 5%. One-stage Duckett urethroplasty for non-distal hypospadias requires fewer operations.

【Key words】 Hypospadias; Surgical Procedures, Operative; Postoperative Complications; Meta-Analysis
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尿道下裂是小儿常见的先天性泌尿生殖系统畸形,发病率约为 1/300,近年来有升高趋势^[1]。根据尿道口位置的不同,尿道下裂可分为远端型、中段型和近端型。非远端型尿道下裂包括中段型和近端型,中段型定义为尿道开口于阴茎体中部的尿道下裂,近端型包括阴茎根部型、阴茎阴囊交界型、阴囊型和会阴型。相比于远端型尿道下裂,非远端型尿道下裂尿道缺损长,阴茎下弯程度重,术中常需横断尿道板,手术修复难度较大,术后并发症发生率更高,其术式选择一直存在争议。对于非远端型尿道下裂中需要横断尿道板以矫正阴茎下弯的患儿,一期横裁包皮岛状皮瓣尿道成形术(one-stage transverse preputial island flap urethroplasty, 一期 Duckett 尿道成形术)是国内应用最多的术式^[2]。国外学者更倾向于采用分期移植尿道成形术(staged graft urethroplasty, 分期 Bracka 尿道成形术)^[3]。目前关于这两种术式的优劣尚无定论,本研究旨在运用循证医学原理评价以上两种术式治疗非远端型尿道下裂的临床疗效及安全性,以期为手术方式的选择提供参考。

资料与方法

一、文献检索策略

计算机检索 PubMed、Embase、Web of Science、Cochrane 图书馆、中国知网、万方数据库和维普数据库。检索词包括尿道下裂、横裁包皮岛状皮瓣、Duckett 术、Bracka 术、移植、hypospadias、preputial flap、foreskin flap、Bracka、graft。检索文献时限为数据库建库至 2022 年 3 月 28 日。此外,查找相关研究的参考文献清单,追溯纳入文献的参考文献,必要时与研究者联系,补充相关文献。

二、文献纳入与排除标准

纳入标准:①随机或非随机对照试验,队列研究和病例对照研究;②研究对象为非远端型尿道下

裂患者;③干预措施为一期 Duckett 尿道成形术或分期 Bracka 尿道成形术者;④初次行尿道手术者;⑤手术年龄 < 18 岁。排除标准:①研究质量差,数据不完整等无法进行信息提取的文献;②样本量 < 10 例的研究;③综述、信件、病例报告、会议摘要及具有相同数据来源的研究。

三、文献筛选流程、质量评价及数据提取方法

由 2 名评价者通过阅读文献题目和摘要,按照纳入及排除标准筛选文献,随后查找并阅读全文进行二次筛选,由 2 名评价者独立进行数据提取,并交叉核对,意见不同时通过咨询相关专家及共同讨论达成一致。提取内容:①纳入研究的基本特征:第一作者、出版年份、尿道下裂类型、样本量、手术年龄和干预方式;②结局指标:总体并发症、独立并发症(尿道瘘、尿道狭窄、尿道憩室、伤口裂开、移植相关并发症及其他并发症)、手术次数。移植相关并发症是指文献中记为术后并发症的移植收缩、挛缩、瘢痕和坏死;伤口裂开是指阴茎头和(或)尿道裂开。纳入研究中无随机对照研究,使用 The Newcastle Ottawa Scale (NOS) 文献质量评价量表进行评价,包括选择(4 分)、可比性(2 分)和结局(3 分),满分为 9 分^[4]。

四、统计学处理

使用 RevMan 5.4 进行统计学分析。首先对各项研究进行异质性检验,采用 Q 和 I^2 值反映各研究间异质性,若 $P \leq 0.1, I^2 \geq 50\%$,可认为多项研究间异质性较大,采用随机效应模型;反之采用固定效应模型。构建森林图以比较一期 Duckett 尿道成形术与分期 Bracka 尿道成形术后总体并发症和独立并发症的发生率。采用比值比(OR)、风险差(RD)和 95% 置信区间(CI)分析统计量。当统计值较小时,使用卡方检验或 Fisher 精确概率法进行统计分析。对于研究中只报道中位数及极值的资料使用 Hozo 等^[5]提出的方法估算均数和标准差。所有研究结果均为双侧检验结果, $P < 0.05$ 为差异具有统计学意义。

结 果

一、文献筛选流程及结果

共检索出文献 1 709 篇,其中 PubMed 271 篇, Embase 337 篇, Web of Science 332 篇, Cochrane 8 篇, 中国知网 254 篇, 万方数据库 404 篇, 维普数据库 103 篇。剔除重复文献后获 789 篇文献。阅读文献标题和摘要后初筛获 107 篇文献;阅读全文后最终纳入 41 篇文章进行 Meta 分析,干预方式中至少包括一期 Duckett 尿道成形术和分期 Bracka 尿道成形术且互为对照的文献有 5 篇。文献筛选流程见图 1。纳入文献基本特征及质量评价见表 1,纳入数据结局指标见表 2。

二、Meta 分析结果

纳入 41 篇文献中共报道 3 713 例患儿,其中 2 395 (64.5%) 例接受一期 Duckett 尿道成形术,平均随访时间为 31.7 个月;1 318 (35.5%) 例接受分期 Bracka 尿道成形术,平均随访时间为 59.6 个月。

(一) 尿道瘘

共 41 篇文献报道术后尿道瘘的发生率,一期 Duckett 尿道成形术与分期 Bracka 尿道成形术后尿道瘘的发生率分别约为 17% (95% CI: 0.14 ~ 0.20, $I^2 = 79%$, 采用随机效应模型)、10% (95% CI: 0.07 ~

0.13, $I^2 = 79%$, 采用随机效应模型), 见图 2。

(二) 尿道狭窄

共 34 篇文献报道术后尿道狭窄的发生率,一期 Duckett 尿道成形术与分期 Bracka 尿道成形术后尿道狭窄的发生率分别约为 10% (95% CI: 0.07 ~ 0.13, $I^2 = 90%$, 采用随机效应模型)、3% (95% CI: 0.02 ~ 0.04, $I^2 = 39%$, 采用固定效应模型), 见图 3。

(三) 尿道憩室

共 16 篇文献报道术后尿道憩室的发生率,一期 Duckett 尿道成形术与分期 Bracka 尿道成形术后尿道憩室的发生率分别约为 4% (95% CI: 0.02 ~ 0.06, $I^2 = 76%$, 采用随机效应模型)、2% (95% CI: 0.01 ~ 0.04, $I^2 = 0%$, 采用固定效应模型), 见图 4。

(四) 伤口裂开

共 20 篇文献报道术后伤口裂开的发生率,一期 Duckett 尿道成形术与分期 Bracka 尿道成形术后伤口裂开的发生率分别约为 2% (95% CI: 0.01 ~ 0.04, $I^2 = 0%$, 固定效应模型)、4% (95% CI: 0.02 ~ 0.06, $I^2 = 73%$, 采用随机效应模型), 见图 5。

(五) 移植植物相关并发症

共 5 篇文献报道分期 Bracka 尿道成形术后移植植物相关并发症的发生率,移植植物相关并发症的发生率约为 5% (95% CI: 0.01 ~ 0.10, $I^2 = 71%$, 随机效应模型), 见图 6。

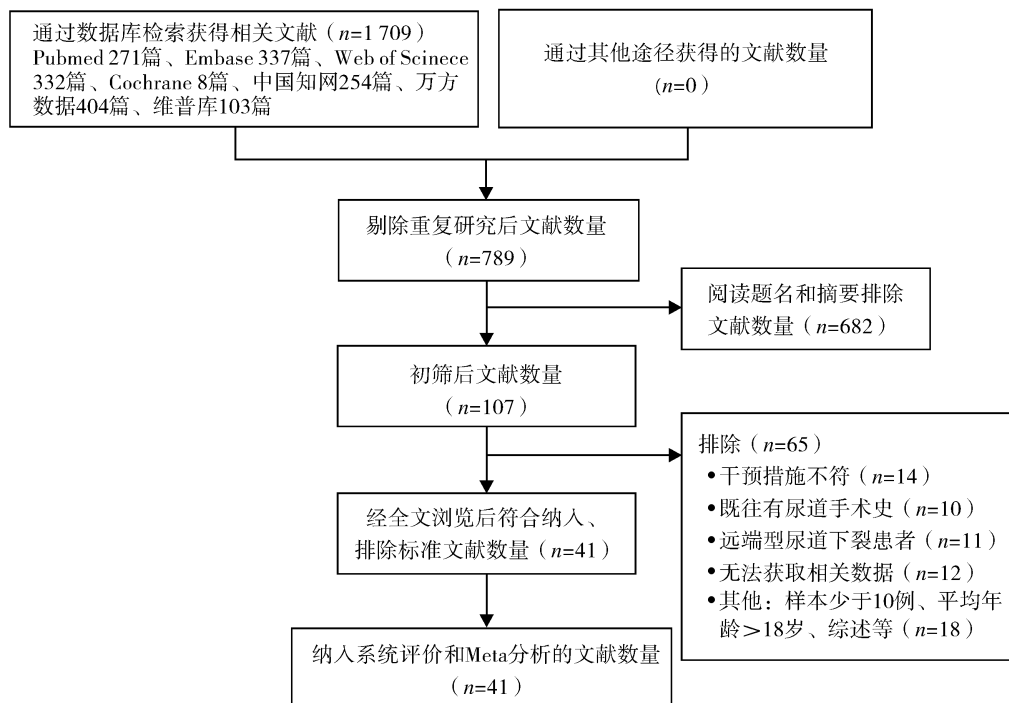


图 1 文献筛选流程图

Fig. 1 Flowchart of literature screening

表 1 两种手术方式治疗非远端型尿道下裂临床疗效研究文献的基本特征及质量评价

Table 1 Basic characteristics and quality evaluation of the included literature items

第一作者, 年份	术式	例数	年龄(月)	随访时间(月)	NOS 评分
Al-Adl, 2020 ^[6]	B	38	26(11-36)	15(6-48)	7
Ali, 2021 ^[7]	B	31	18(9-60)	40(12-50)	7
Badawy, 2020 ^[8]	B	37	12(6-132)	38.40(12-54)	6
Faure, 2016 ^[9]	B	44	15(6-92.4)	47.60(36-63)	6
Joshi, 2015 ^[10]	B	30	48(24-120)	6-24	7
Manasherova, 2020 ^[11]	B	220	48(12-204)	/	6
Misra, 2019 ^[12]	B	36	22(10-108)	96	7
Moursy, 2010 ^[13]	B	41	14.40 ± 5.30	33.20 ± 9.20	7
Pfistermüller, 2016 ^[14]	B	208	16(10-204)	75(12-137)	7
Pippi Salle, 2016 ^[15]	B	60	17.60	29.60	7
Radhakrishnan, 2020 ^[16]	B	180	22 ± 10	74.40 ± 49.20	6
Saltzman, 2018 ^[17]	B	34	16(13-22)	28.30	7
Snodgrass, 2017 ^[18]	B	43	13.70(3-100)	22(1.50-42)	6
Springer, 2012 ^[19]	B	32	21(15-26)	35(20-55)	5
Wani, 2020 ^[20]	B	74	27.60(8-55.20)	27.40(16-72)	7
俞斌, 2009 ^[21]	D	20	20.33 ± 5.03	47.60(36-63)	6
	B	30	193.20(84-408)	/	
Rudin, 2014 ^[22]	D	43	26.40(6-204)	6-36	6
	B	20	26.40(6-204)	6-36	
Zheng, 2015 ^[23]	D	32	90(24-420)	28.5(20-60)	7
	B	34	132(24-516)	35(18-60)	
Sadeghi, 2017 ^[24]	D	78	32.40 ± 31.20	60(12-120)	7
	B	86	32.40 ± 31.20	60(12-120)	
关勇, 2019 ^[25]	D	42	20.33 ± 5.03	47.60(36-63)	8
	B	40	19.70 ± 6.60	47.60(36-63)	
Castañón, 2000 ^[26]	D	42	37(12-108)	/	7
Chuang, 1995 ^[27]	D	103	47(5-168)	/	6
Cui, 2020 ^[28]	D	155	21.60(6-144)	62.40(3-120)	6
Daboos, 2020 ^[29]	D	160	54	36	7
Demirbilek, 1997 ^[30]	D	32	51.60(20-168)	/	6
Dewan, 1991 ^[31]	D	189	6-120	25.10 ± 23.70	6
Ghali, 1999 ^[32]	D	148	38.40(18-144)	23(6-53)	6
Han, 2020 ^[33]	D	161	14-186	13.70(12-17)	6
Hayashi, 2001 ^[34]	D	13	23(10-36)	36(30-44)	6
Huang, 2016 ^[35]	D	32	11(7-23)	23(12-38)	6
Huang, 2017 ^[36]	D	65	33.60(7-144)	19(14-30)	7
蒋先镇, 2011 ^[37]	D	356	66(6-504)	3-168	6
Lyu, 2019 ^[38]	D	40	26.20 ± 13.80	12	7
Macgillivray, 2002 ^[39]	D	24	27.50(21-35)	62.50(4-100)	7
Patel, 2004 ^[40]	D	14	16.80(8-74)	170(144-253)	8
Sorber, 1997 ^[41]	D	70	6-168	16.70(12-92)	7
Wang, 2019 ^[42]	D	320	15.10(11-64)	40.20(1-156)	6
余玲, 2019 ^[43]	D	140	21.60 ± 13.20	12	7
章越龙, 2009 ^[44]	D	57	92.40 ± 68.40	8-72	5
张卫星, 2013 ^[45]	D	34	52.40 ± 14.80	1-24	6
Zheng, 2012 ^[46]	D	25	145.40 ± 128.40	38.70(22-60)	7

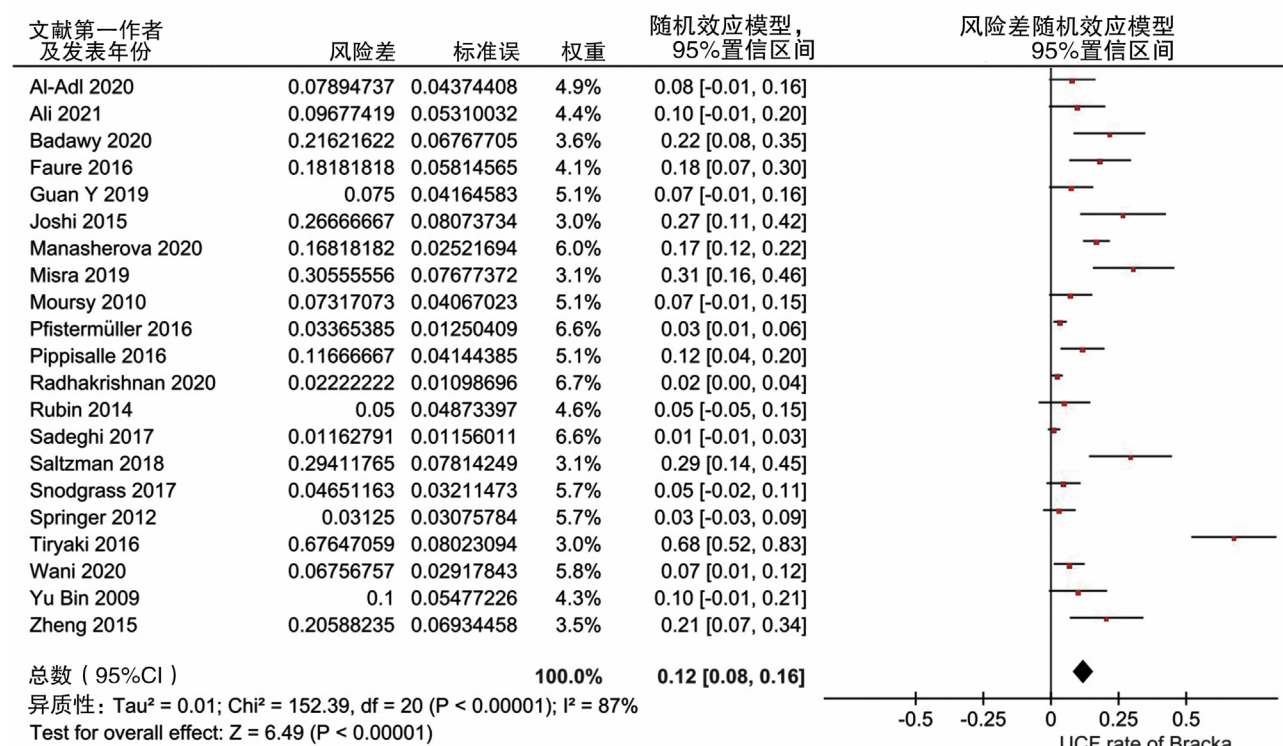
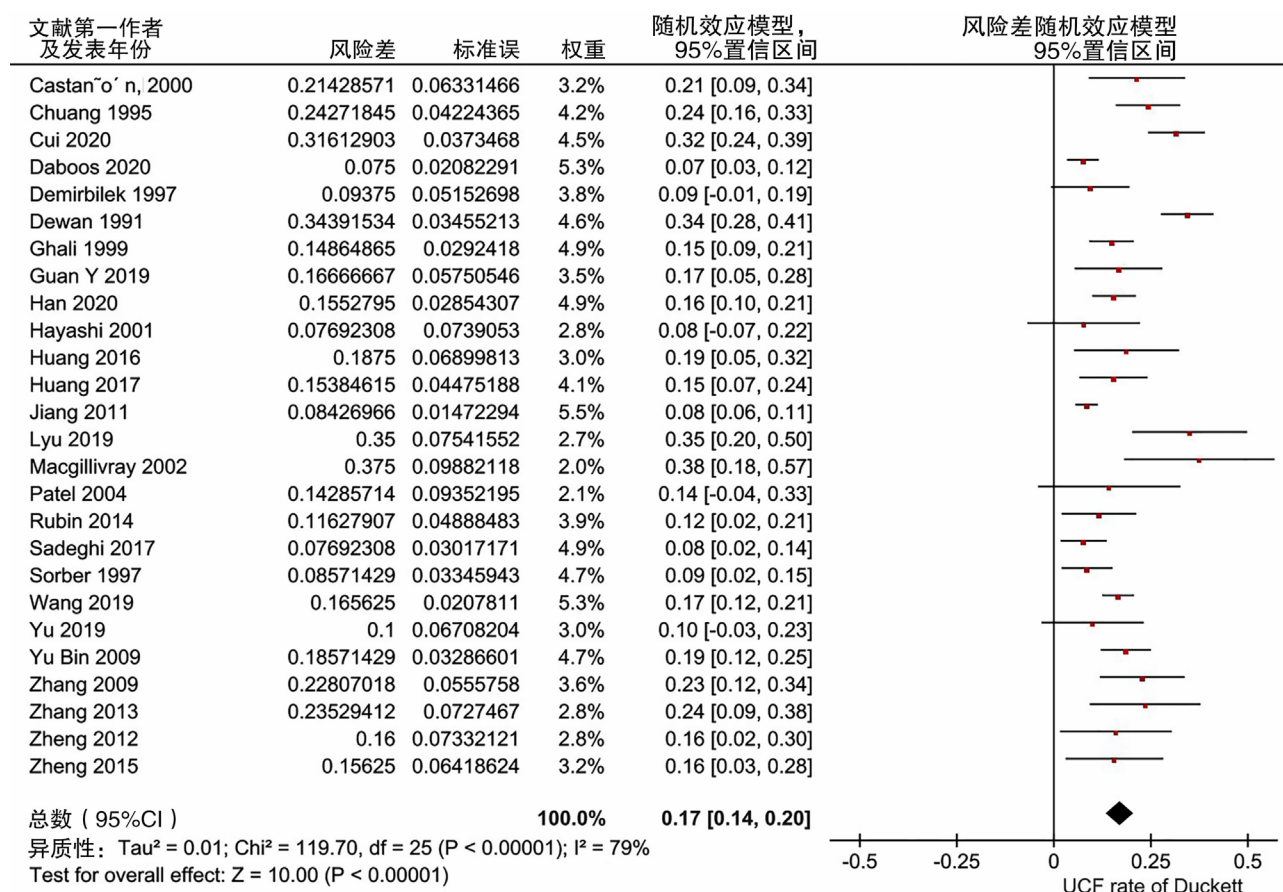
注 B:分期 Bracka 尿道成形术; D:一期 Duckett 尿道成形术; NOS 分:根据文献质量评价量表得出的评分; /:代表文献中未描述

表 2 两种手术方式治疗非远端型尿道下裂临床疗效研究文献的结局指标

Table 2 Outcomes included in the literature

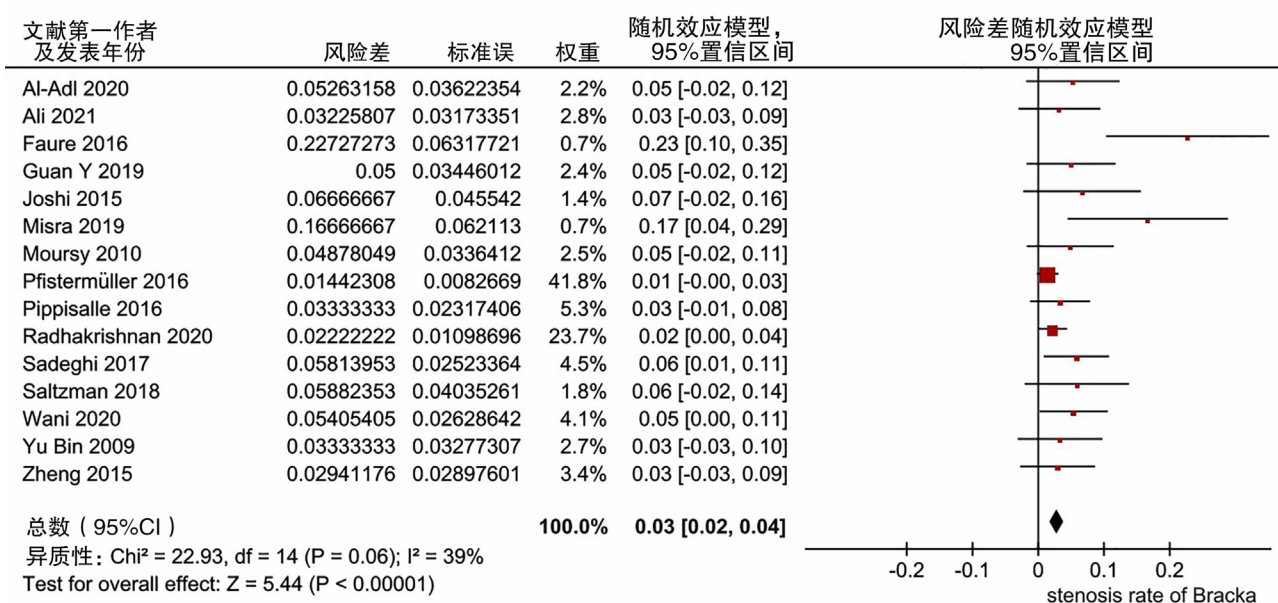
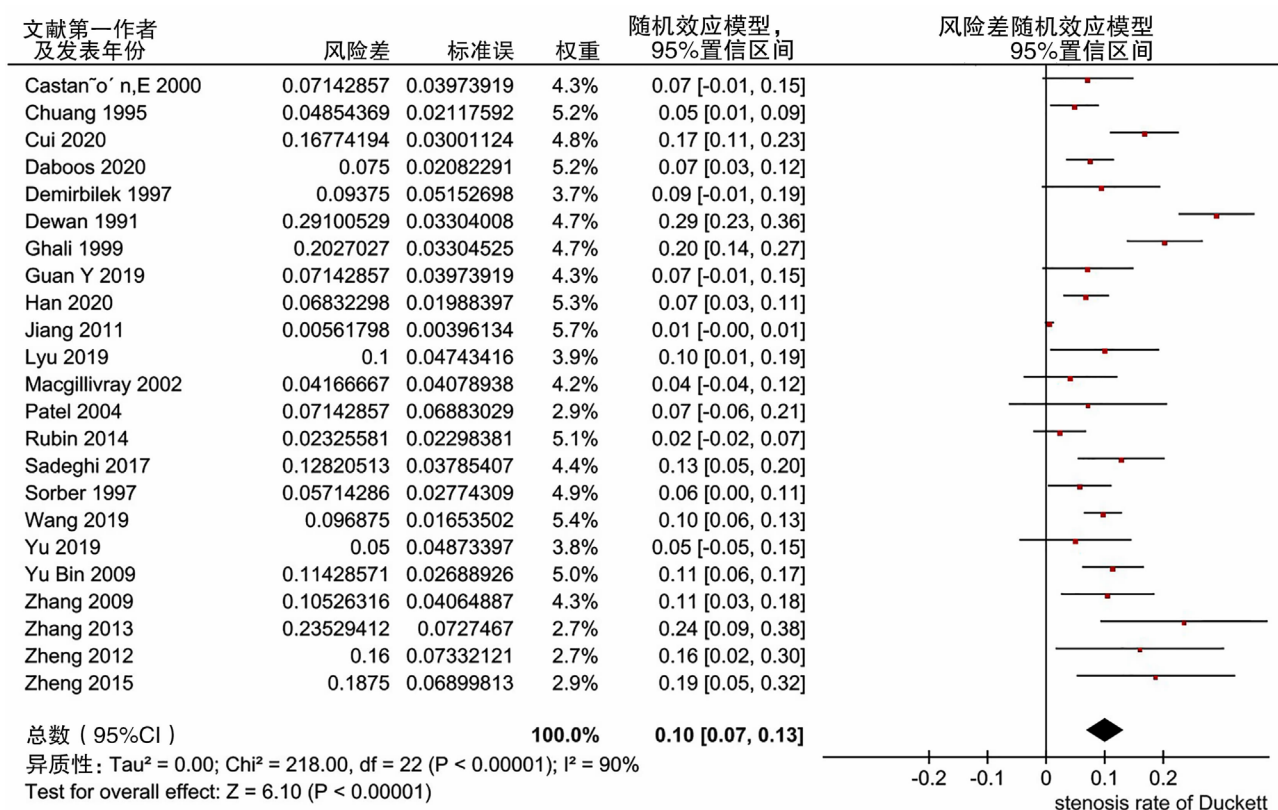
第一作者, 年份	术式	例数	术后并发症(例)							总手术次数
			合计	移植物相关并发症	尿道瘘	尿道狭窄	尿道憩室	伤口裂开	其他	
Al-Adl, 2020 ^[6]	B	38	6	/	3	2	1	1	3	81
Ali, 2021 ^[7]	B	31	7	/	3	1	2	1	0	/
Badawy, 2020 ^[8]	B	37	19	/	8	/	/	9	2	89
Faure, 2016 ^[9]	B	44	23	3	8	10	1	1	/	107
Joshi, 2015 ^[10]	B	30	20	10	8	2	/	/	/	63
Manasherova, 2020 ^[11]	B	220	56	5	37	/	/	14	/	/
Misra, 2019 ^[12]	B	36	20	1	11	6	/	1	1	/
Moursy, 2010 ^[13]	B	41	6	/	3	2	/	1	/	88
Pfistermüller, 2016 ^[14]	B	208	21	/	7	3	/	3	8	428
Pippi Salle, 2016 ^[15]	B	60	23	/	7	2	1	10	3	139
Radhakrishnan, 2020 ^[16]	B	180	10	/	4	4	/	2	/	367
Saltzman, 2018 ^[17]	B	34	28	1	10	2	1	12	3	96
Snodgrass, 2017 ^[18]	B	43	10	/	2	/	1	7	/	95
Springer, 2012 ^[19]	B	32	2	/	1	/	/	/	1	/
Wani, 2020 ^[20]	B	74	11	/	5	4	/	2	/	157
俞斌, 2009 ^[21]	D	20	3	/	2	1	/	/	/	23
	B	30	4	/	3	1	/	/	/	64
Rudin, 2014 ^[22]	D	43	6	/	5	1	/	/	/	/
	B	20	1	/	1	/	/	/	/	/
Zheng, 2015 ^[23]	D	32	8	/	5	6	/	1	/	/
	B	34	8	/	7	1	/	1	/	/
Sadeghi, 2017 ^[24]	D	78	21	/	6	10	1	/	4	83
	B	86	7	/	1	5	/	1	/	173
关勇, 2019 ^[25]	D	42	14	/	7	3	1	3	/	56
	B	40	4	/	3	2	/	/	/	84
Castañó n, 2000 ^[26]	D	42	16	/	9	3	2	/	2	/
Chuang, 1995 ^[27]	D	103	31	/	25	5	1	/	/	/
Cui, 2020 ^[28]	D	155	84	/	49	26	9	/	/	195
Daboos, 2020 ^[29]	D	160	28	/	12	12	/	4	/	176
Demirbilek, 1997 ^[30]	D	32	6	/	3	3	/	/	/	/
Dewan, 1991 ^[31]	D	189	93	/	65	55	5	/	/	282
Ghali, 1999 ^[32]	D	148	48	/	22	30	7	/	3	/
Han, 2020 ^[33]	D	161	42	/	25	11	5	/	/	/
Hayashi, 2001 ^[34]	D	13	1	/	1	/	/	/	/	14
Huang, 2016 ^[35]	D	32	6	/	6	/	/	/	/	38
Huang, 2017 ^[36]	D	65	10	/	10	0	/	/	/	75
蒋先镇, 2011 ^[37]	D	356	32	/	30	2	/	/	/	/
Lyu, 2019 ^[38]	D	40	19	/	14	4	1	/	/	/
Macgillivray, 2002 ^[39]	D	24	10	/	9	1	/	/	/	34
Patel, 2004 ^[40]	D	14	3	/	2	1	/	/	/	17
Sorber, 1997 ^[41]	D	70	16	/	6	4	/	4	2	/
Wang, 2019 ^[42]	D	320	125	/	53	31	41	/	/	445
余玲, 2019 ^[43]	D	140	44	/	26	16	/	2	/	/
章越龙, 2009 ^[44]	D	57	19	/	13	6	/	/	/	/
张卫星, 2013 ^[45]	D	34	12	/	8	8	/	/	3	/
Zheng, 2012 ^[46]	D	25	6	/	4	4	/	1	/	31

注 B:分期 Bracka 尿道成形术; D:一期 Duckett 尿道成形术; /:代表文献中未描述



注 UCF: urethrocutaneous fistula 尿道瘘; Duckett: 一期 Duckett 尿道成形术; Bracka: 分期 Bracka 尿道成形术

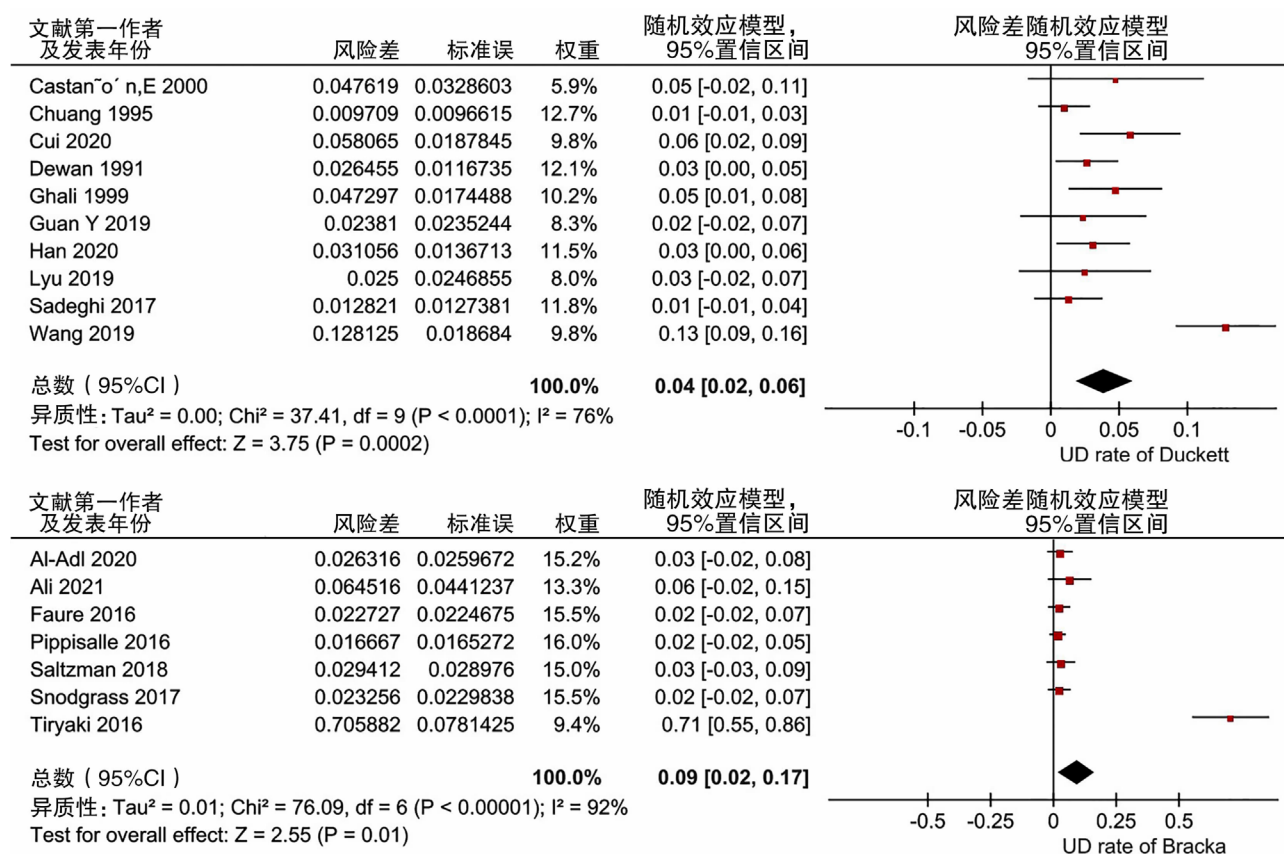
图2 两种手术治疗尿道下裂后尿道瘘森林图
 Fig. 2 Forest plot of postoperative urethral fistula



注 stenosis: 狭窄; Duckett: 一期 Duckett 尿道成形术; Bracka: 分期 Bracka 尿道成形术

图 3 两种手术治疗尿道下裂后尿道狭窄森林图

Fig. 3 Forest plot of postoperative urethral stricture



注 UD: urethral diverticulum 尿道憩室; Duckett: 一期 Duckett 尿道成形术; Bracka: 分期 Bracka 尿道成形术

图4 两种手术治疗尿道下裂后尿道憩室森林图

Fig.4 Forest plot of postoperative urethral diverticulum

(六) 两种手术对比研究文献的术后总并发症

有 5 篇文献报道干预措施同时包括一期 Duckett 尿道成形术和分期 Bracka 尿道成形术,且互为对照。研究之间无明显异质性($I^2 = 22\%$, $P = 0.28$),合并结果显示一期 Duckett 尿道成形术后总并发症发生率高于分期 Bracka 尿道成形术,差异有统计学意义($OR = 2.63$, $95\% CI: 1.54 \sim 4.50$, $P < 0.05$, 固定效应模型),见图 7。

(七) 平均手术次数

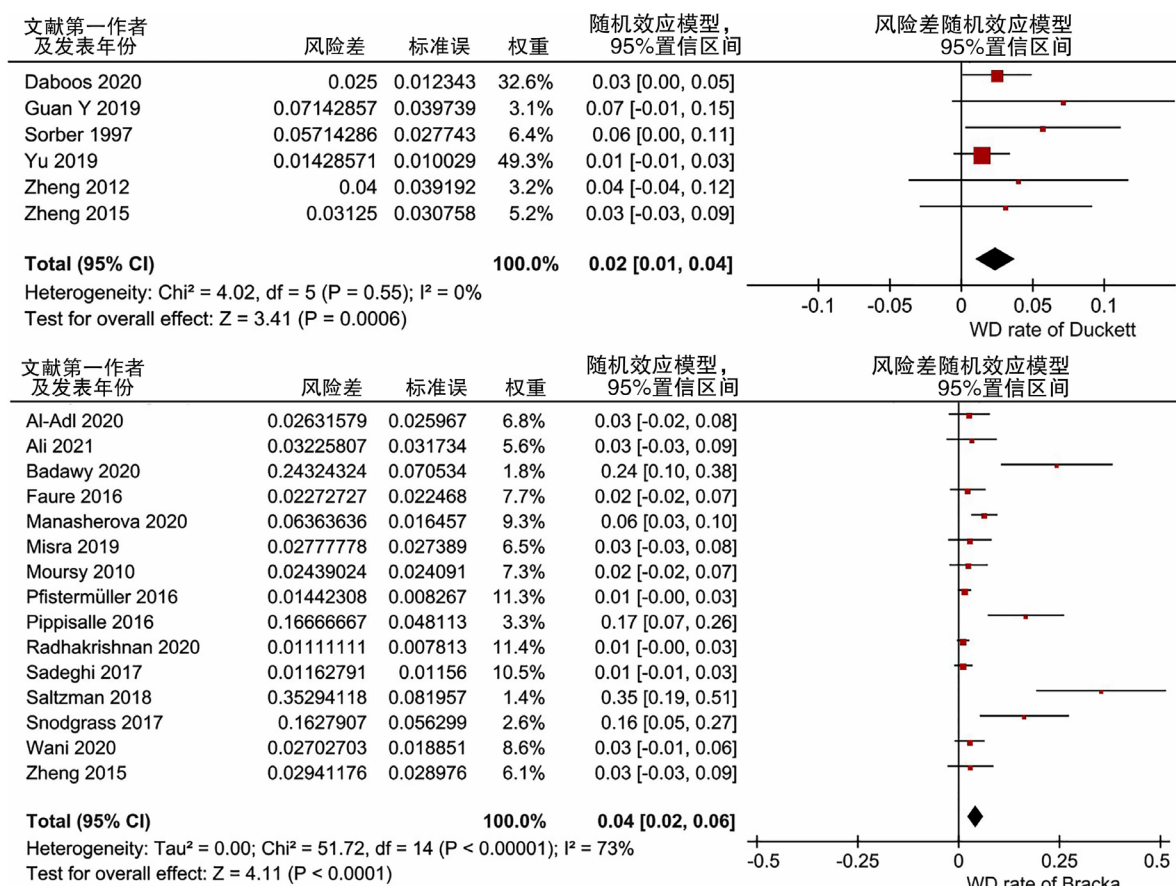
共 25 篇文献报道了手术次数,包括 2 082 例患儿。其中 1 137 例接受一期 Duckett 尿道成形术,平均手术次数为 1.29 次;945 例接受分期 Bracka 尿道成形术,平均手术次数为 2.15 次。

讨 论

尿道下裂是小儿泌尿生殖系统常见的先天性畸形,与远端型尿道下裂相比,非远端型尿道下裂治疗难度大,预后较差,术式选择存在较大争议。一期 Duckett 尿道成形术在国内有较广泛的应用基础,而国际上目前更倾向于选择分期 Bracka 尿道成

形术^[2-3]。这可能与临床上非远端型尿道下裂病例相对较少、缺乏一期 Duckett 尿道成形术经验、分期 Bracka 尿道成形术学习曲线较短有关^[47]。近年来国内也显现出从一期转向分期的趋势,但两者优劣尚无明确共识。就术式而言,分期 Bracka 尿道成形术一期矫正阴茎下弯后使用移植物重建尿道板,二期行尿道成形术;而一期 Duckett 尿道成形术一次手术即完成阴茎下弯的矫正及尿道成形。分期 Bracka 尿道成形术需至少进行两次手术,比较两种术式两次手术后并发症的发生率可能更有临床意义。然而一期 Duckett 尿道成形术后仅部分发生并发症的患儿需进行再次手术,且纳入文献中多为初次手术后的并发症情况,故本研究仅分析分期 Bracka 两次手术后及一期 Duckett 一次手术后并发症的发生率,旨在评价一期 Duckett 尿道成形术与分期 Bracka 尿道成形术治疗非远端型尿道下裂的疗效,为手术方式的选择提供循证依据。

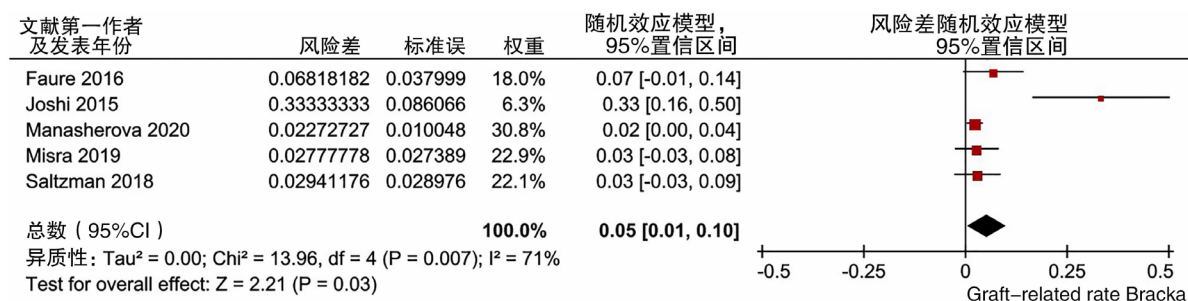
本研究纳入 41 篇文献中,报道一期 Duckett 尿道成形术与分期 Bracka 尿道成形术及其相关结果的文献分别有 26 篇和 20 篇,有 5 篇文献的干预措施同时包括上述两种术式,且互为对照。分析结果



注 WD: wound dehiscence 伤口裂开; Duckett: 一期 Duckett 尿道成形术; Bracka: 分期 Bracka 尿道成形术

图 5 两种手术治疗尿道下裂后伤口裂开森林图

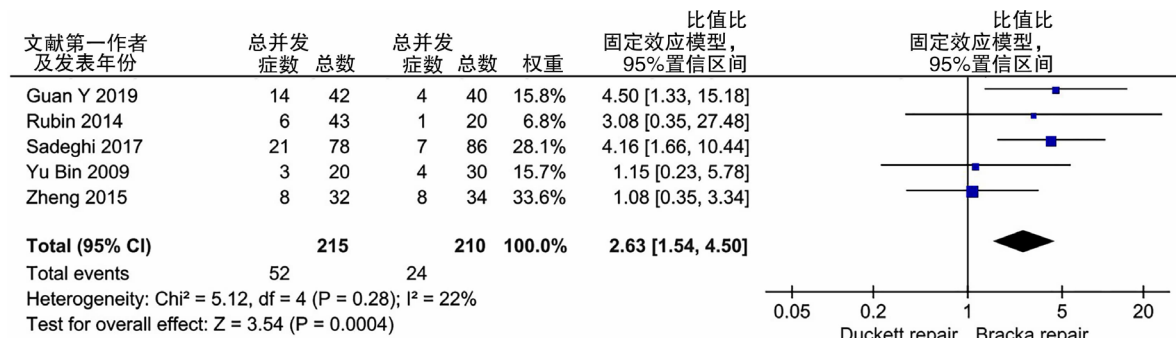
Fig. 5 Forest plot of postoperative wound dehiscence



注 Graft-related: 移植植物相关; Duckett: 一期 Duckett 尿道成形术; Bracka: 分期 Bracka 尿道成形术

图 6 两种手术治疗尿道下裂后移植植物相关并发症森林图

Fig. 6 Forest plot of postoperative graft-related complications



注 Duckett: 一期 Duckett 尿道成形术; Bracka: 分期 Bracka 尿道成形术

图 7 尿道下裂两种手术方式对比研究的术后总并发症森林图

Fig. 7 Forest plot of total postoperative complications for comparative studies

显示,一期 Duckett 尿道成形术后尿道瘘(17%)、尿道狭窄(10%)及尿道憩室的发生率(4%)均高于分期 Bracka 尿道成形术(10%、3%及2%),与 Sadeghi 等、关勇等^[24-25]研究结果一致。考虑与分期手术的两次手术至少间隔 6 个月,有利于重建尿道板建立良好的血运,减少尿道瘘的发生有关;而一期 Duckett 尿道成形术中近端尿道口的环形吻合有可能增加尿道狭窄的发生率。另外,一期 Duckett 手术成形尿道由于缺乏与周围组织的附着,新尿道富有弹性,易于扩张,形成憩室^[48]。Shukla 等^[49]对 Duckett 术式进行改良,将皮瓣边缘纵向锚定到腹面以优化尿道板的重建,从而减少尿道憩室的发生。

纳入的 5 篇对比研究经 Meta 分析显示,一期 Duckett 尿道成形术后总并发症的发生率高于分期 Bracka 术式($OR = 2.63, P < 0.01$),其中有 3 篇得出相同结果^[22,24-25];另 2 篇的数据表明两种术式总并发症发生率差异无统计学意义^[21,23]。需强调的是,尿道下裂手术后并发症的发生率不应作为衡量术式优劣的唯一评价指标。首先,分期 Bracka 尿道成形术存在移植物相关并发症,本研究中一期 Bracka 尿道成形术后移植物相关并发症发生率经合并后估计为 5%。Leslie 等^[50]研究发现分期颊黏膜移植中,约 13% 的患儿需重新进行移植。本研究结果显示一期 Duckett 与分期 Bracka 尿道成形术平均手术次数分别为 1.29 次与 2.15 次,相比于分期手术,一期 Duckett 尿道成形术治愈非远端型尿道下裂所需手术次数更少。此外,分期 Bracka 尿道成形术的治疗周期在 6 个月以上,相对更多的手术次数和更长的治疗周期也是手术者在进行术式选择时需要综合考虑的因素^[51]。

尿道下裂的治疗决策十分复杂,术式选择受尿道下裂严重程度、术者经验及家长意愿等多方面因素影响。一期 Duckett 尿道成形术具有一次完成手术、平均治疗周期短的优点;分期 Bracka 尿道成形术后并发症的发生率相对较低。故一期 Duckett 尿道成形术对于伴有阴茎下弯且尿道缺损不严重的病例是较好的选择,而分期 Bracka 尿道成形术中移植物的使用在包皮组织少、包皮无主干血管的病例中具有不可替代的作用^[25]。

本研究 I^2 统计结果显示出高异质性,这可能与以下几个方面因素有关:①目前关于尿道下裂术式选择缺乏前瞻性队列研究和随机对照研究,本研究为回顾性研究,数据来自多个中心,异质性不可避免^[52];②尿道下裂手术结局与术者经验高度相关,

相比分期手术,一期 Duckett 尿道成形术学习曲线较长,可能导致偏倚^[53];③尿道下裂术后并发症的发生时间存在差异,随访结果与随访时间密切相关,不同研究的随访时长可能导致相应并发症的低估,如阴茎复弯作为长期并发症,在随访时间短的文献中很少提及,无法进行统计分析;④不同文献对并发症的定义不同,部分文献报告了更多的并发症,如出血、感染、阴茎扭转、疼痛等^[14,17];而一些文献关注于主要并发症,如尿道瘘、尿道狭窄、尿道憩室^[26]。此外,本研究未纳入术后阴茎外观和性功能的相关数据,这是由于其评估尚无统一标准,且需长期随访,纳入文献中数据缺失较多,也无法进行更有效的 Meta 分析。Castagnetti 等^[54]研究发现分期手术的美观效果明显优于一期手术。Rynja 等^[55]研究表明,一期 Duckett 尿道成形术可以实现与健康对照组相当的长期功能、性功能及美观效果。

综上所述,对于非远端型尿道下裂,一期 Duckett 尿道成形术后总并发症发生率、尿道瘘及尿道狭窄发生率高于分期 Bracka 尿道成形术,移植物相关并发症在分期 Bracka 尿道成形术后的发生率为 5%。一期 Duckett 尿道成形术治愈非远端型尿道下裂所需手术次数更少。但现有文献中缺乏大样本、长期随访的随机对照试验以得出有效证据。此外,已有研究对于尿道下裂术后阴茎外观和青春期后性功能的评价尚缺乏统一标准,应在未来的研究中进一步完善。

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