

肌腱转位术在不可修复性肩袖损伤中的应用

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摘要 不可修复性肩袖损伤(IRCT)治疗一直以来都是肩关节外科和运动医学科的难点。有学者提出,可通过肌腱转位的形式将肩关节周围肌肉进行合理改建,达到改善或替代肩袖功能的效果。常用肌腱转位术有背阔肌转位术(LDT)、斜方肌转位术、胸大肌转位术、大圆肌转位术、三角肌肌瓣转位术和胸小肌转位术等。对于以上肩袖损伤为主的 IRCT,可考虑斜方肌转位术、胸大肌转位术及胸小肌转位术;对于以后上肩袖损伤为主的 IRCT,可考虑 LDT、斜方肌转位术、大圆肌转位术及三角肌肌瓣转位术;对于反式肩关节置换术后肩关节功能加强或翻修,可考虑大圆肌转位术及 LDT。该文就肌腱转位术在 IRCT 中的应用作一综述。

关键词 肩袖损伤;不可修复性;肌腱转位

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随着人类社会老龄化的加剧,肩袖损伤导致的肩关节功能障碍在临床上日益凸显。据报道,老年人群肩袖损伤发病率达 20.7%^[1]。若未能及时诊治,随着病程的发展,肌肉组织将出现萎缩和脂肪浸润,肩袖腱性部分出现吸收、缺失、回缩和粘连等情况^[2],逐步发展成不可修复性肩袖损伤(IRCT)。有文献^[3]报道,IRCT 治疗失败率高达 94%。

由于肩袖损伤的修复性取决于损伤特性及术者操作技术水平,故 IRCT 尚缺乏绝对统一的定义。Rockwood 等^[4]将 IRCT 定义为关节清理后,上臂位于内收位时,肩袖组织萎缩明显、脂肪浸润严重、不能进行直接缝合修复的肩袖损伤。IRCT 不等于巨大肩袖损伤,前者的特点是在临床治疗中无法直接进行缝合修复,往往具有肩袖组织严重萎缩与脂肪浸润、肱骨头上方固定性半脱位、肩峰-肱骨头距离小于 5 mm 等特征^[2],后者的特点则是肩袖撕裂直径超过 5 cm^[5]或损伤肌腱不少于 2 组^[6],但不一定不可修复。

目前临床上针对 IRCT 的治疗方法主要有保守治疗(如对症治疗、物理治疗、局部封闭等)^[7]、关节镜下单纯清理术、肩峰下减压成形术、肱二头肌肌腱切断或固定术、肩袖部分修补术、肩袖重建术、上关节囊重建术、肌腱转位术和反式肩关节置换术等^[3-4,7-12]。其中保守治疗可缓解部分疼痛等症状,

但尚无证据表明其治疗效果优于手术治疗^[7];关节镜下单纯清理术、肩峰下减压成形术、肱二头肌肌腱切断或固定术属于姑息性手术,可暂时缓解症状,但对肩关节功能恢复十分有限;肩袖部分修补术短期内对部分 IRCT 患者较有效,可恢复其部分肩关节功能,但长期效果不尽如人意^[9,13-14];肩袖重建术、上关节囊重建术和反式肩关节置换术分别由于操作技巧要求较高、生物材料进口壁垒和植入材料价格昂贵等原因在国内应用受限;肌腱转位术应用于肩袖损伤始于 20 世纪 80 年代^[15],其基本思路是将肩关节周围具有足够强度的肌肉进行改建,赋予其与损伤肩袖组织相似的力矩,以期具有肩袖的功能,可避免修补 IRCT 的难题,达到对 IRCT 功能性治疗的效果^[16-17]。

1 背阔肌转位术

背阔肌起于 T₆~L₅ 棘突、骶骨和髂嵴,止于肱骨小结节嵴和结节间沟,止点处肌腱宽度可达 5 cm 且腱性部分较长,是肌腱转位术常用的供区组织^[15-16]。背阔肌转位术(LDT)应用于 IRCT 治疗时,可为肱骨提供良好的外旋力矩及部分外展力矩,是初发及翻修的后上肩袖损伤治疗方案之一^[18],尤其对外旋功能障碍伴有肩部疼痛的患者疗效较好,但对三角肌功能减退和慢性肩关节假性麻痹的患者疗效欠佳^[19-22]。

单纯应用 LDT 治疗以后上肩袖损伤为主的 IRCT 时,患者满意度达 80% 以上,其中 89% 的患者疼痛得到较好缓解,超过半数患者肩关节活动度和功能得到一定程度的恢复,仅不到 10% 的患者认为疗效甚微或无效^[3,9,21,23-25];术后肩关节主动前举

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角(AAE)得到明显改善($P < 0.0001$),平均 AAE 由术前小于 80° 恢复至术后大于 140° ^[21,25];肩关节外旋功能得到明显改善,平均外旋角由术前 22.4° 恢复至术后 36.4° ,恢复率达 62.5%;肩关节外展功能得到明显改善,平均外展角由术前 33.2° 恢复至术后 50.4° ,恢复率达 51.8%;肩关节完全康斯坦特评分(CST)由术前平均 35.8 分恢复至术后平均 58 分,提高 63%;平均美国肩与肘协会评分系统(ASES)指数由术前 30 提高至术后 70,平均 Constant-Murley 肩关节功能评分(CMS)由术前 35.5 分提高至术后 69.5 分,超过 70% 的患者肌力得到部分恢复^[7,16,22-26]。

学术界对 LDT 可恢复肩关节外旋功能认识一致,但对于其是否能改善肩关节上举和外展功能尚存争议。Valenti 等^[16]研究认为,AAE 越小的 IRCT 患者 LDT 疗效越明显。Codsi 等^[22]研究认为,AAE 狭小是 IRCT 术后预后不良的表现。Namdari 等^[27]研究认为,LDT 不能改善肩关节上举功能,治疗后上肩袖损伤的效果有限。Gerber 等^[28]研究认为,LDT 后转位的背阔肌并无类似肩袖的功能,肩关节外展功能的改善可能与转位的背阔肌下压肱骨头有关。

Gerber^[29]研究发现,LDT 对肩胛下肌和三角肌萎缩的 IRCT 患者疗效十分有限。多学者^[18,30]对 LDT 中如何维持肩关节周围肌肉平衡及手术适用性等进行了进一步研究,认为转位的背阔肌具有双重功能,一方面能下压肱骨头达到外展肩关节的作用,另一方面可稳定肩关节后部,加强三角肌外展与上举功能。因此,功能健全的肩胛下肌有助于维持肩关节前、后力量的平衡。此外,有效的三角肌是 LDT 预期疗效的重要参考因素^[15]。但三角肌在 LDT 中的作用仍存争议。Miniaci 等^[19]研究认为,三角肌功能对 LDT 手术结果并无客观影响。Costouros 等^[31]研究认为,小圆肌与 LDT 临床效果有关,术前应评估小圆肌脂肪浸润程度及其功能。

LDT 后发生严重并发症(如神经损伤等)或严重感染等非常罕见,但部分患者腋下瘢痕粘连严重,需进一步手术治疗^[16]。由于目前多数研究随访时间较短,LDT 后远期肩关节改变尚不明确。据报道,LDT 后远期肩关节骨关节炎(OA)发生率及肌肉脂肪浸润程度有所增加^[2,16,26,32]。

2 斜方肌转位术

斜方肌起自枕外隆凸、 $C_7 \sim T_{12}$ 棘突,上束止于

锁骨外侧及肩峰突,中下束止于肩胛棘尖端和上唇。自 Elhassan 等^[33]提出斜方肌转位术手术设计以来,临床上多学者根据斜方肌转位术的特点将其应用于以前上或以后上肩袖损伤为主的 IRCT 治疗。但由于斜方肌腱性部分较短,其转位术往往需结合自体或异体移植物进行。Omid 等^[34]对比斜方肌转位术与 LDT 修复 IRCT 的生物力学特性,发现 LDT 在肩关节外展 0° 位时对 IRCT 肱骨内旋角度过大有限制作用,而斜方肌转位术在肩关节任何外展角度时均对肱骨内旋角度过大有限制作用,认为斜方肌转位术对限制 IRCT 患者肱骨过度内旋有较大帮助。研究^[35]发现,转位后的斜方肌下束可成为肩关节周围极好的外旋动力肌肉供源,仅次于大圆肌,而转位后的背阔肌可提供的外旋动力极弱。此外,斜方肌转位术操作较 LDT 简单^[17]。

Goutallier 等^[36]对经斜方肌转位术治疗的内旋功能明显受限的 IRCT 患者随访 2 年,发现术后疼痛明显减轻,日常活动得到改善,CST 评分提升明显,肩关节内旋功能明显改善,但外旋功能较术前有所减退($P = 0.0583$),CT 检查显示肱骨头半脱位状态改善,未见明显肩关节 OA 和肌肉进展性脂肪变。多学者^[17,37]得出类似结论,但未见术后肩关节外旋功能明显减退,患者满意度较高。此外,斜方肌下束转位术亦可用于修复以后上肩袖损伤为主的 IRCT,可改善患者肩关节外旋功能,对假性麻痹患者同样有效^[33,35,38-39]。但斜方肌转位术对体重指数(BMI)极高或伴有臂丛神经损伤的 IRCT 患者疗效有限,且较易发生并发症^[17]。

3 胸大肌转位术

胸大肌起自锁骨近端、胸骨和第 1~6 肋软骨,肌束向外逐渐集中,止于肱骨大结节,呈扇形分布^[40],转位后的胸大肌可部分代偿肩胛下肌功能,提供前方力偶,进而内旋盂肱关节^[41]。Wirth 等^[42]报道采用胸大肌转位术治疗以肩胛下肌损伤为主的 IRCT 后,多学者对其进行了进一步研究。总体上,胸大肌转位术治疗以肩胛下肌损伤为主的 IRCT 有效^[43],患者疼痛可得到缓解,CST 评分明显提高($P < 0.01$),患者总体满意度较高^[44-48]。从肩关节活动范围来看,采用胸大肌转位术治疗以肩胛下肌损伤为主的 IRCT,肩关节前举和外展功能可得到明显改善,但多数研究^[46,48-49]认为术后肩关节外旋功能存在一定程度上的受限,仅少量研究^[46]报道术后肩关节外旋功能不受影响。Jost 等^[46]、Lederer

等^[49]研究认为,胸大肌转位术对肩关节外展肌力改善明显。

术式不同可能影响胸大肌转位术的临床效果。Konrad 等^[50]研究发现,胸大肌肌腱固定于联合腱下方时,盂肱关节动力学性能优于固定于联合腱上方。临床研究^[43]结果也印证了以上结论,前者 CST 评分为 (63 ± 4) 分,明显优于后者的 (57.3 ± 7) 分 $(P < 0.001)$ 。Valenti 等^[51]对比胸大肌锁骨止点(上部)肌腱转位与胸骨肋骨止点(下部)肌腱转位对 IRCT 的治疗效果,认为两者均能较好缓解疼痛、增加肩关节肌力、恢复肩关节功能。Jennings 等^[44]研究认为,胸大肌上部肌腱转位后需与三角肌对抗,因此对 IRCT 的治疗效果较差。

胸大肌转位术并发症及二次手术可能性不容忽视,常见并发症有永久性腋神经损伤(0.5%)、一过性肌皮神经损伤(0.5%)、需手术处理的深部感染(1%)、转位肌腱断裂(13.3%)、深静脉血栓(0.5%)等^[43]。

4 大圆肌转位术

大圆肌起自肩胛骨下角背面,止于肱骨小结节,具有内旋、内收、后伸肩关节的作用。Combes 等^[52]对以后上肩袖损伤为主的 IRCT 进行解剖学研究,认为大圆肌有足够长的腱性部分,可胜任 IRCT 的转位修复。Buijze 等^[53]对比大圆肌与背阔肌的解剖学特性后也得出类似结论,但强调大圆肌腱性结构较背阔肌短,进行转位术难度较大。Celli 等^[54]于 1998 年首次报道了一系列采用大圆肌转位术成功治疗的 IRCT 病例,之后多学者对其进行了进一步基础研究和临床实践。总体而言,大圆肌转位术治疗 IRCT 可使疼痛得到缓解,肩关节功能得到部分恢复^[18,55-57]。IRCT 患者大圆肌转位术后生物力学、肌电反应及病理生理学等多方面测试结果亦支持临床结果,转位后的大圆肌可很好地代偿部分冈上肌和冈下肌功能,恢复肩关节外旋和上举功能^[58-59],推测其机制为转位的大圆肌保证了盂肱关节的稳定性而达到恢复肩关节外展功能的效果,而并非大圆肌提供了外展力矩^[60]。但也有研究^[58]表明,大圆肌转位术对疼痛缓解有限,远期不能避免肩关节 OA 的发生。

此外,大圆肌转位术也常联合 LDT 用于 IRCT 治疗^[61]及反式肩关节置换术后肩关节功能加强或翻修,可明显减轻疼痛,提高患者满意度,改善肩关节功能。

5 其他术式

由于 IRCT 损伤情况不同和手术方式差异,肌腱转位术临床效果存在差异。Augereau 等^[62]改良了三角肌肌瓣转位术并将其广泛应用于巨大肩袖损伤的治疗,亦可用于治疗 IRCT。总体上,三角肌肌瓣转位术治疗 IRCT(尤其是以后上肩袖损伤为主的 IRCT)的近中期并发症发生率较低,可很好地缓解疼痛,提高患者生活质量^[63-67]。Gille 等^[66]采用三角肌肌瓣转位术治疗 IRCT 患者,发现患者平均 CST 评分由术前 25.7 分提高至术后 72.3 分,肩关节活动度也有一定程度的改善。但三角肌肌瓣转位术对肩部肌力影响较大,术后部分患者可能丧失术前的肌力及肩关节前举能力^[16],其远期效果不尽如人意,肌瓣断裂率高达 50%,肩关节 OA 发生率高达 70%^[65]。

对以前肩袖损伤为主的 IRCT,可采用胸小肌转位术治疗。转位的胸小肌肌腱可轻松触及肩胛下肌足印区,在临床应用中可操作性较高。Paladini 等^[68]对 27 例经胸小肌转位术治疗的 IRCT 患者随访 2 年,未出现臂丛神经、肌皮神经损伤或移植物断裂等并发症,患者平均肩关节前屈活动度由术前 127°恢复至术后 177°,平均 CST 评分提高 41 分,但平均肩关节外旋活动度减小 11°,肌力无明显改善。总体而言,胸小肌转位术是治疗以肩胛下肌损伤为主的 IRCT 安全可选术式。

一直以来,IRCT 的治疗都是肩关节领域的重大挑战,对于考虑手术治疗的患者均应进行详尽的术前评估(包括体检及影像学评估等),以了解其肩关节活动度、功能情况,肩袖损伤部位、大小及残存肌肉组织脂肪浸润情况等,选取合适术式。采用肌腱转位术治疗 IRCT 时,应根据患者肩袖损伤特点及自身条件选取最优术式。对于既往以上肩袖损伤为主的 IRCT,可考虑斜方肌转位术、胸大肌转位术及胸小肌转位术;对于以后上肩袖损伤为主的 IRCT,则可考虑 LDT、斜方肌转位术、大圆肌转位术及三角肌肌瓣转位术;对于反式肩关节置换术后肩关节功能加强或翻修,可考虑大圆肌转位术及 LDT。

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