中国脑性瘫痪康复指南(2015):第八部分

中国康复医学会儿童康复专业委员会
中国残疾人康复协会小儿脑性瘫痪康复专业委员会
《中国脑性瘫痪康复指南》编委会

第四章　脑性瘫痪的康复治疗

第四节　药物治疗

近二十年应用于脑瘫患儿的抗痉挛药物主要有:①缓解局灶性痉挛药物:神经肌肉阻滞剂(A型肉毒毒素)和化学去神经支配(苯酚、乙醇);②缓解全面性痉挛药物:口服药物(苯二氮卓类、丹曲林、巴氯芬、替扎尼定)和巴氯芬鞘内注射。此外,脑瘫患儿因负重、营养和抗惊厥药应用等因素,常出现低骨密度和骨质疏松,易造成骨折,故临床上使用维生素D、钙补充剂和双磷酸盐等相应药物以改善脑瘫患儿骨密度[1]。

一、A型肉毒毒素

证据

1.缓解下肢痉挛

剂量对照研究显示步态动力学与运动学有显著的剂量-效应相关性,高剂量比低剂量在站立位或摆动时有更显著的踝关节背屈活动,且效用更持久[2](1个Ⅰ级证据)。随机对照研究采用粗大运动功能测试量表评估结果显示A型肉毒毒素明显提高下肢功能和改善步态[3—4](1个Ⅰ级证据、1个Ⅱ级证据)。病例对照研究中,接受A型肉毒毒素治疗后12周,应用医师评价量表对患儿步态进行分析,步态改善明显,评分高于正常对照组的2倍[3](1个Ⅰ级证据)。使用A型肉毒毒素与安慰剂对照研究证明,治疗组的下肢功能较安慰剂组有显著改善[5—7](3个Ⅰ级证据)。

2.缓解上肢痉挛

研究表明注射A型肉毒毒素短期内能明显改善上肢功能,但对长期上肢运动功能改善不明显[8—11](4个Ⅰ级证据)。联合OT则效果更好,能提升肘部及拇指主动伸展,以及降低腕部、肘部的肌张力,但手抓握的功能测试只有轻微提升,捡硬币测试显示手功能无明显改善[12](1个Ⅱ级证据)。随机对照试验观察上肢重复注射A型肉毒毒素联合OT与单用OT治疗结果发现,该方法使痉挛得到持续缓解,父母能感知到患儿的明显进步[9](1个Ⅰ级证据)。回顾性研究表明注射A型肉毒毒素的严重不良事件很低[13](1个Ⅰ级证据)。

推荐

A型肉毒毒素注射是一种有效、安全的缓解痉挛的治疗技术,缓解下肢痉挛的效果优于缓解上肢痉挛的效果(推荐强度A级)。

二、苯酚、乙醇

证据

乙醇、苯酚局部注射可用于缓解脑瘫患儿的局部痉挛[14—16](3个Ⅳ级证据)。1971年后未见文献报道,但在2014年国际物理医学与康复学会上仍有专家应用乙醇、苯酚和A型肉毒毒素分别局部注射治疗痉挛的报告。

推荐

可配合A型肉毒毒素用于缓解脑瘫患儿的局部痉挛(推荐强度D级)。

DOI:10.3969/j.issn.1001-1242.2016.02.027

三、地西泮

证据

大样本随机对照研究表明地西泮治疗3周后,发现呈剂量依赖性的肌张力减低、被动活动范围增加和自主运动能力提高,但没有明显的功能改善[17](1个Ⅰ级证据)。地西泮联合丹曲林的应用与安慰剂组比较痉挛得到显著缓解[18](1个Ⅱ级证据)。另有报道地西泮还能提高脑瘫患儿行为与协调能力[19](1个Ⅱ级证据)。

推荐

短期应用地西泮可缓解脑瘫患儿的全面痉挛(推荐强度A级),联合丹曲林使用效果明显(推荐强度B级)。

四、丹曲林

证据

丹曲林可改善腱反射和减轻剪刀步[20](1个Ⅱ级证据)。有报道丹曲林对痉挛、运动和肌力均无明显影响[21](1个Ⅰ级证据);但另一同样剂量(4—12mg/kg·d)的研究表明,丹曲林可减轻痉挛,虽然粗大运动功能无改善,但日常生活活动能力(包括穿衣、饮食方面的协调能力,自主玩耍时的肢体控制,耐力和活动自由度等)有显著提高[22](1个Ⅱ级证据)。

推荐

1.丹曲林可改善腱反射、剪刀步和日常生活活动能力(推荐强度B级)。

2.丹曲林可缓解脑瘫的痉挛,但有争议(推荐强度B级)。

五、巴氯芬

证据

口服巴氯芬的研究结果不太一致,使用剂量为每天10—60mg的一个双盲交叉试验结果显示巴氯芬可减轻痉挛,具体表现为被动关节活动度增大,但对能独立行走的患儿没有明显的功能改善[23](1个Ⅱ级证据);另一个双盲安慰剂交叉试验,用同样的剂量和年龄分组,用目的达到量表评估发现结果有改善,但应用改良后的Tardieu 量表和儿童生活功能量表(pediatric evaluation of disability inventory,PEDI)评估患儿后发现,痉挛和功能并无明显改善[24](1个Ⅱ级证据)。

鞘内注射巴氯芬可长期缓解脑瘫患儿的痉挛和改善运动功能[25—30](1个Ⅲ级证据,5个Ⅳ级证据)。鞘内注射巴氯芬的副作用有脑脊液漏、导管故障和软组织感染等[31](1个Ⅱ级证据)。

推荐

1.口服巴氯芬可缓解脑瘫患儿的痉挛和被动关节活动度增大,仍有一些争议(推荐强度B级)。

2.鞘内注射巴氯芬可缓解脑瘫患儿的痉挛和改善运动功能,同时需注意预防副作用(推荐强度C级)。

六、替扎尼定

证据

小样本安慰剂对照研究使用剂量0.05mg/kg·d的替扎尼定2周,结果发现痉挛减轻、姿势及腱反射改善,但未做功能评估,亦未发现副作用,肝功能正常,该药被认为有可能用于缓解脑瘫患儿痉挛的治疗[32](1个Ⅱ级证据)。

推荐

替扎尼定可减轻痉挛(推荐强度B级)。

七、左乙拉西坦

证据

研究显示2例不随意运动型脑瘫患儿应用左乙拉西坦单一治疗,利用视频和视觉类比量表评估结果,显示令人印象深刻的平衡控制和精细运动有进步,没有发现副作用,而且治疗效果可以维持26个月以上[33](1个Ⅳ级证据)。

推荐

左乙拉西坦可改善不随意运动型脑瘫患儿平衡控制和精细运动(推荐强度D级)。

八、双磷酸盐类药物、维生素D和钙补充剂

证据

随机、安慰剂对照的临床试验提示氨羟二磷酸二钠可以提高脑瘫患儿的骨密度，是一种安全和非常有效的方法[34]（1个Ⅰ级证据），并可降低骨折风险[35]（1个Ⅱ级证据）。口服阿仑酸钠1mg/kg/week可以治疗脑瘫患儿合并的骨质疏松症，且疗效肯定[36]（1个Ⅱ级证据）。同时服用抗癫痫药的患儿需要摄入高于正常推荐摄入量的维生素D和钙补充剂，以维持骨密度[37]（1个Ⅲ级证据）。

推荐

1.氨羟二磷酸二钠可以提高脑瘫患儿的骨密度（推荐强度A级）。

2.口服阿仑酸钠可治疗脑瘫患儿合并骨质疏松症（推荐强度B级）。

3.服用抗癫痫药的脑瘫患儿需要摄入高于正常推荐摄入量的维生素D和钙补充剂（推荐强度C级）。

九、神经生长因子

证据

神经生长因子具有促进神经元存活、轴突定向再生、髓鞘生成和促进有效连接，恢复感觉、运动和认知功能。据报道鼠神经生长因子对脑卒中、颅脑损伤、脊髓损伤、周围神经病及周围神经损伤、新生儿缺氧缺血性脑病等有效[38—40]（3个Ⅱ级证据）。有研究神经生长因子可提高婴幼儿脑瘫的运动和智力发育，以及改善肌张力、姿势异常和反射异常[41—44]（4个Ⅳ级证据）。但缺少大样本队列对照研究的循证医学依据。

推荐

神经生长因子可用于缺氧缺血性脑病，脊髓和周围神经损伤等的治疗，应用于脑瘫治疗尚缺少大样本研究的循证医学依据（推荐强度D级）。

参考文献

[1] Delgado MR, Hirtz D, Aisen M, et al. Practice Parameter: Pharmacologic treatment of spasticity in children and adolescents with cerebral palsy (an evidence based review) : Report of the Quality Standards Subcommittee of the American Academy of Neurology and the Practice Committee of the Child Neurology Society[J]. Neurology, 2010, 75(7):669.

[2] Polak F, Morton R, Ward C, et al. Double-blind comparison study of two doses of botulinum toxin A injected into calf muscles in children with hemiplegic cerebral palsy[J]. Dev Med Child Neurol，2002, 44(8):551—555.

[3] Ubhi T, Bhakta BB, Ives HL, et al. Randomised double blind placebo controlled trial of the effect of botulinum toxin on walking in cerebral palsy[J].Arch Dis Child, 2000, 83(6): 481—487.

[4] Steenbeek D, Meester-Delver A, Becher JG, et al.The effect of botulinum toxin type A treatment of the lower extremity on the level of functional abilities in children with cerebral palsy: evaluation with goal attainment scaling[J]. Clin Rehabil, 2005, 19(3):274—282.

[5] Moore AP, Ade-Hall RA, Smith CT, et al. Two-year placebo-controlled trial of botulinum toxin A for leg spasticity in cerebral palsy [J]. Neurology，2008, 71(2):122—128.

[6] Baker R, Jasinski M, Maciag TI, et al. Botulinum toxin treatment of spasticity in diplegic cerebral palsy: a randomized, double-blind, placebo-controlled, dose ranging study[J]. Dev Med Child Neurol. 2002, 44(10):666—675.

[7] Kanovsky P, Bares M, Severa S, et al. Functional benefit of botulinum toxin (Dysport) in the treatment of dynamic equinus cerebral palsy spasticity: a prospective, multicenter, double-blind, placebo-controlled study[J]. Ces A Slov Neurol Neurochir，2004, 67(1):16—23.

[8] Fehlings D, Rang M, Glazier J, et al. An evaluation of botulinum-A toxin injections to improve upper extremity function in children with hemiplegic cerebral palsy[J]. J Pediatr，2000,137(3):331—337.

[9] Lowe K, Novak I, Cusick A. Low-dose/high-concentration localized botulinum toxin A improves upper limb movement and function in children with hemiplegic cerebral palsy[J]. Dev Med Child Neurol, 2006, 48(3):170—175.

[10] Wallen M, O'Flaherty SJ, Waugh MC. Functional outcomes of intramuscular botulinum toxin type a and occupational therapy in the upper limbs of children with cerebral palsy: a randomized controlled trial[J].Arch Phys Med Rehabil，2007, 88(1):1—10.

[11] Kawamura A, Campbell K, Lam-Damji S, et al. A randomized controlled trial comparing botulinum toxin A dosage in the upper extremity of children with spasticity[J]. Dev Med Child Neurol, 2007, 49(5):331—337.

[12] Corry IS, Cosgrove AP, Walsh EG, et al. Botulinum toxin A in the hemiplegic upper limb: a double-blind trial[J]. Dev Med Child Neurol, 1997, 39(3):185—193.

[13] O'Flaherty SJ, Janakan V, Morrow AM, et al. Adverse events and health status following botulinum toxin type A injections in children with cerebral palsy[J]. Dev Med Child Neurol, 2011, 53(2):125—130.

[14] Tardieu G, Tardieu C, Hariga J, et al. Treatment of spasticity in injection of dilute alcohol at the motor point or by epidural

route. Clinical extension of an experiment on the decerebrate cat[J]. Dev Med Child Neurol,1968, 10(5):555—568.
[15] Spira R. Management of spasticity in cerebral palsied children by peripheral nerve block with phenol[J]. Dev Med Child Neurol, 1971, 13(2):164—173.
[16] Yadav SL, Singh U, Dureja GP, et al. Phenol block in the management of spastic cerebral palsy[J]. Indian J Pediatr, 1994, 61(3): 249—255.
[17] Mathew A, Mathew MC, Thomas M, et al. The efficacy of diazepam in enhancing motor function in children with spastic cerebral palsy[J]. Trop Pediatr,2005, 51(2):109—113.
[18] Nogen AG. Medical treatment for spasticity in children with cerebral palsy[J]. Childs Brain,1976; 2(5):304—308.
[19] Engle HA. The effect of diazepam (Valium) in children with cerebral palsy: a double-blind study[J]. Dev Med Child Neurol, 1966, 8(6):661—667.
[20] Haslam RH, Walcher JR, Lietman PS, et al. Dantrolene sodium in children with spasticity[J]. Arch Phys Med Rehabil，1974, 55 (55):384—388.
[21] Joynt RL, Leonard JA. Jr. Dantrolene sodium suspension in treatment of spastic cerebral palsy[J]. Dev Med Child Neurol, 1980, 22 (6):755—767.
[22] Denhoff E, Feldman S, Smith MG, et al. Treatment of spastic cerebral-palsied children with sodium dantrolene[J]. Dev Med Child Neurol,1975, 17(6):736—742.
[23] Milla PJ, Jackson AD. A controlled trial of baclofen in children with cerebral palsy[J]. Int Med Res, 1977,5(6):398—404.
[24] Scheinberg A, Hall K, Lam LT, et al. Oral baclofen in children with cerebral palsy: a double-blind cross-over pilot study[J].Paediatr Child Health, 2006, 42(11):715—720.
[25] Albright AL, Barry MJ, Fasick MP, et al. Effects of continuous intrathecal baclofen infusion and selective posterior rhizotomy on upper extremity spasticity[J]. Pediatr Neurosurg, 1995, 23(2):82—85.
[26] Wiens HD. Spasticity in children with cerebral palsy: a retrospective review of the effects of intrathecal baclofen[J]. Issues Compr Pediatr Nurs, 1998, 21(1):49—61.
[27] Grabb PA, Guin-Renfroe S, Meythaler JM. Midthoracic catheter tip placement for intrathecal baclofen administration in children with quadriparetic spasticity[J]. Neurosurgery, 1999, 45(4):833—836.
[28] Awaad Y, Tayem H, Munoz S, et al. Functional assessment following intrathecal baclofen therapy in children with spastic cerebral palsy[J]. Child Neurol,2003, 18(1):26—34.
[29] Bjornson KF, McLaughlin JF, Loeser JD, et al. Oral motor, communication, and nutritional status of children during intrathecal baclofen therapy: a descriptive pilot study[J]. Arch Phys Med Rehabil, 2003, 84(4):500—506.
[30] Murphy NA, Irwin MC, Hoff C. Intrathecal baclofen therapy in children with cerebral palsy: efficacy and complications[J]. Arch Phys Med Rehabil, 2002, 83(12):1721—1725.
[31] Motta F, Buonaguro V, Stignani C. The use of intrathecal baclofen pump implants in children and adolescents: safety and complications in 200 consecutive cases[J]. Neurosurg, 2007, 107(1Suppl):32—35.
[32] Vasquez-Briceno A, Arellano-Saldana ME, Leon-Hernandez SR, et al. The usefulness of tizanidine. A one-year follow-up of the treatment of spasticity in infantile cerebral palsy[J]. Rev Neurol. 2006, 43(3):132—136.
[33] Vles GF, Hendriksen JG, Visschers A, et al. Levetiracetam therapy for treatment of choreoathetosis in dyskinetic cerebral palsy[J]. Dev Med Child Neurol, 2009, 51(6):487—490.
[34] Richard C. Henderson, Robert K, et al. Bachrach, Bisphosphonates to treat osteopenia in children with quadriplegic cerebral palsy: A randomized,placebo-controlled clinical trial[J]. Pediatr, 2002, 141(5):644—651.
[35] Bachrach SJ, Kecskemethy HH. Decreased fracture incidence after 1 year of pamidronate treatment in children with spastic quadriplegic cerebral palsy[J]. Dev Med Child Neurol, 2010, 52(9):837—842.
[36] Vurucu S, Paksu MS, Karaoglu A, et al. Osteopenia in children with cerebral palsy can be treated with oral alendronate[J].Childs Nerv Syst，2012, 28(2):283—286.
[37] Elizabeth A, Sharon B, Stevenson. Bone health in children with cerebral palsy and epilepsy[J]. Pediatr Health Care, 2012, 26(3): 193—199.
[38] 中国神经生长因子临床应用专家共识协作组. 神经生长因子(恩经复)临床应用专家共识[J]. 中华神经医学杂志, 2012, 11(4):416—420.
[39] Claudia F, Domenico C, Pietro F,et al. Neuroprotective Role of Nerve Growth Factor inHypoxic-Ischemic[J].Brain Injury Brain Sciences，2013, 3(3):1013—1022.
[40] María A. Davis-Lo´pezde C, Camilo J, et al. Nerve growth factor regulates the firing patterns and synaptic composition of motoneurons[J]. The Journal of Neuroscienc, 2010, 30(24):8308—8319.
[41] 严超英, 马丙祥, 尚青. 神经生长因子多中心治疗小儿脑性瘫痪疗效观察[J]. 中华神经医学杂志, 2005, 4(4): 383—386.
[42] 万鸽. 鼠神经生长因子治疗小儿脑性瘫痪的疗效分析[J]. 现代药物, 2014, 8(2):88—90.
[43] 陶维娜. 神经生长因子治疗儿童脑性瘫痪临床观察[J]. 中国实用医药, 2014, 23(8):167—168.
[44] 李勇裴. 鼠神经生长因子治疗婴幼儿脑性瘫痪的疗效观察[J]. 全科医学临床与教育,2011, 9(1):20—22.

（本节编写人员：麦坚凝　唐亮　唐久来）

第五节　手术治疗

一、矫形手术

证据

脑瘫有多种矫形手术方法，肌腱延长、肌腱转移、旋转截骨术等是进展性脑瘫肌肉骨骼病变常用的矫形手术方法，选择合适的时机进行矫形手术可以缓解肌肉痉挛、平衡肌力、矫正畸形、调整肢体负重力线、改善运动功能，为康复治疗创造有利条件。

1.上肢矫形手术　脑瘫上肢矫形手术复杂且具有挑战性，其目的在于恢复手的日常生活活动能力、运动功能，改善外观。脑瘫上肢矫形手术有：拇指内收畸形手术，尺神经运动分支切断术，骨间肌、小指展肌、掌骨骨间肌切断术，腕关节融合术，尺侧腕屈肌转移术，旋前圆肌松解术等。上肢矫形手术疗效均缺乏有效的证据支持[1—3]（3个Ⅳ级证据）。

2.脊柱矫形手术　脑瘫的脊柱侧凸较为复杂，确定是否手术及采取哪种手术存在一定的困难。当患者脊柱侧凸Cobb角达40°以上时，可以考虑手术治疗，多采用脊柱融合术。患有神经性脊柱侧凸的脑瘫可行脊柱融合术[4—7]（2个Ⅲ级证据，2个Ⅳ级证据），矫正脊柱畸形，纠正骨盆倾斜，手术时建议应用颈/脑干躯体感觉诱发电位进行脊髓监测，避免严重并发症。脊柱融合术后可能会引起消化功能障碍、异位骨化，应避免同时进行髋关节和脊柱手术。

3.下肢矫形手术：脑瘫在发育过程中常出现异常步态，下肢骨与关节可产生各种挛缩畸形，下肢矫形手术主要原则在于矫正力线，平衡肌力。

（1）关节矫形手术：髋关节脱位在痉挛型脑瘫中较为常见，但目前在手术时机、预后等问题上仍未得到统一。综合性手术治疗痉挛性髋关节脱位是有效的，手术方法为股骨旋转截骨术+髋关节切开复位/骨盆截骨术，骨盆截骨术适用于：年龄1—6岁、髋臼指数小于45°、股骨头大小与髋臼基本适应的患儿。软组织松解手术结合股骨旋转截骨术可以矫正脑瘫骨盆旋转，髋臼成形术结合股骨截骨术及软组织松解术可改善脑瘫患儿股骨头畸形，腰大肌和相关软组织松解手术结合股骨近端缩短和Chiari截骨术，对半脱位并伴有疼痛的青少年或成年脑瘫有效[8—15]（2个Ⅲ级证据，6个Ⅳ级证据）。髋关节疾患严重的脑瘫可行全髋关节置换术，痉挛型脑瘫伴发髋关节疼痛和脱位的患者，行近端股骨切除关节置换术可能有一定疗效。单侧髋关节手术对严重痉挛型双瘫或四肢瘫患者是相对禁忌的，不适用于6岁以下或髋关节轻度脱位的患者。

痉挛型脑瘫患儿行软组织手术，包括腰大肌切断术、腰肌-股直肌转移、单纯内收肌切断术、内收肌切断术结合闭孔神经切除术，可以减少髋脱位发生率，预防痉挛性髋关节脱位[16—18]（1个Ⅱ级证据，1个Ⅲ级证据，1个Ⅳ级证据）。髋关节不稳定的脑瘫不推荐使用软组织松解术。

传统的软组织手术虽然不能降低高肌张力，但可矫正固定性挛缩和畸形。对于髋关节屈曲畸形，常采用髂腰肌松解术、股直肌松解术。髋内收畸形，常采用内收肌切断术或配合闭孔神经前支切断术。软组织松解手术可改善脑瘫患儿的步态，内收短肌、股薄肌移位术可纠正剪刀步态，股直肌转移术和腘绳肌手术可增加步长[19—21]（1个Ⅲ级证据，2个Ⅳ级证据）。

（2）膝关节矫形手术：股直肌转移术和腘绳肌手术可用于治疗具有移动能力的痉挛型脑瘫，增加患儿站立位膝关节伸直角度、增加步长。僵直步态的脑瘫可行股直肌转移术[22—23]（2个Ⅲ级证据）。当脑瘫膝关节活动范围小于正常80%时，应进行股直肌转移术，不应进行股直肌远端松解术。近端股直肌松解术不能改善痉挛型脑瘫屈髋肌挛缩和步态异常。GMFCS Ⅳ级的脑瘫行股直肌远端转移术会增加术后膝关节屈曲，GMFCS Ⅳ级的脑瘫不宜行股直肌远端转移术。痉挛型脑瘫行腘绳肌内外侧延长术，可改善腘窝角，增加立位膝关节最大伸直角，改善步行能力及运动功能，但膝过伸的风险高于腘绳肌内侧延长术[24—27]（2个Ⅲ级证据，2个Ⅳ级证据）。重度屈膝畸形的痉挛型脑瘫行软组织矫形加Ilizarov外固定支架术，可取得较为满意的效果。

（3）踝关节矫形手术：痉挛型脑瘫马蹄足可行跟腱延长术，矫正畸形，改善痉挛[28—32]（1个Ⅱ级证据，2个Ⅲ级证据，2个Ⅳ级证据）。脑瘫跟腱延长术疗效好，但小腿三头肌力会减弱，需要使用地面反作用力支具。偏瘫、需单侧手术非偏瘫型脑瘫、不需要后期外科手术的脑瘫，跟腱延长术疗效最好。对有固定和动态马蹄内翻足的脑瘫，需要进行腓肠肌筋膜延长术、腓肠肌-比目鱼肌延长术、小腿三头肌延长术。患有痉挛性马蹄内翻足畸形的偏瘫型脑瘫患儿可行胫后肌部分转移、肌腱延长术，8岁以下或不能独立在社区内步行的双瘫和四肢瘫型脑瘫不应进行胫后肌手术。

脑瘫性外翻足，6岁之前一般考虑保守治疗和软组织手术，年长患儿应采用骨性手术来矫正足外翻。关节外距下关节融合术可矫正脑瘫后足外翻[33—38]（3个Ⅲ级证据，3个Ⅳ级证据），改善脑瘫痉挛性扁平外翻足畸形，矫正中足外翻，但不能矫正足外翻畸形合并严重的前足外展畸形，不能矫正前足旋后、跟骨跖屈。改良距下关节融合术对脑瘫患儿背侧距舟关节半脱位有一

定疗效。

(4)一次麻醉下的多部位手术(single-event multilevel surgery,SEMS):SEMS也称为多部位手术或改善步态手术,是指在一次麻醉下矫正多个部位的软组织和骨性畸形。有移动能力的痉挛型脑瘫建议SEMS治疗,改善静态挛缩和膝关节运动功能,提高患儿的运动功能、步态、移动能力、粗大运动功能和生活质量,术后患者家长满意度高[39—48](5个Ⅱ级证据,2个Ⅲ级证据,3个Ⅳ级证据)。大龄脑瘫患儿行SEMS长期疗效好。步态严重异常的痉挛型双瘫SEMS只能短期改善患儿的步态,很多患者需要进行其他手术治疗。与未行手术患儿相比,行上肢SEMS的脑瘫患儿抓握-伸展能力并没有显著提高[49](1个Ⅲ级证据)。

推荐

1.脊柱融合术是神经肌肉性脊柱侧凸脑瘫的治疗方法(推荐强度C级)。

2.综合性手术方案(软组织手术结合股骨旋转截骨术、股骨内翻旋转截骨术结合髋关节切开复位/骨盆截骨术)是痉挛性髋脱位脑瘫患者治疗的一种选择(推荐强度C级)。

3.软组织手术是预防痉挛型脑瘫髋关节脱位的一种治疗选择(推荐强度C级)。

4.软组织手术是矫正下肢固定性挛缩和畸形、改善异常步态的一种治疗选择(推荐强度C级)。

5.股直肌转移术是僵直步态脑瘫治疗的一种选择(推荐强度C级)。

6.腘绳肌延长术是改善痉挛型脑瘫膝关节活动度的一种治疗选择(推荐强度C级)。

7.跟腱延长术是痉挛性马蹄足畸形脑瘫治疗的一种选择(推荐强度C级)。

8.关节外距下关节融合术是足外翻畸形脑瘫治疗的一种选择(推荐强度C级)。

9.SEMS是有移动能力的痉挛型脑瘫改善步态的一种选择(推荐强度B级)。

二、脊神经后根切断术

证据

脊神经后根切断术(selective posterior rhizotomy, SPR /selective dorsal rhizotomy,SDR)需根据患儿具体情况、痉挛部位,选择L2—L5、S1后根节段,配合电刺激监测,结合个人经验选择性切断马尾神经,这是决定疗效的重要因素,选择合适的患者对于手术成功至关重要。脊神经后根切断术可有效减轻中度到重度痉挛型脑瘫的痉挛程度,改善功能,提高步行能力,对脑瘫身体机构和功能领域有积极的长期影响[50—57](2个Ⅰ级证据,5个Ⅲ级证据,1个Ⅳ级证据)。脊神经后根切断术可能对3—8岁、GMFCS Ⅲ—Ⅳ级的脑瘫最有效[58](1个Ⅰ级证据),但对GMFCSII-III级的患儿长期改善作用微弱,对GMFCS Ⅳ-Ⅴ级的患儿无长期持续改善作用[59](1个Ⅲ级证据)。痉挛型双瘫、轻度四肢瘫、不能进行巴氯芬鞘内注射或药物治疗无反应的脑瘫可行脊神经后根切断术,需要轮椅移动和智力发育迟缓的痉挛型四肢瘫患儿、10岁以上的脑瘫、肌张力障碍、手足徐动、共济失调的患儿不宜行脊神经后根切断术。选择性颈神经后根切断术可解除上肢痉挛,改善肢体功能,但部分患者术后仍有肘关节屈曲、前臂旋前、腕关节屈曲等畸形。行脊神经后根切断术时应进行术中电生理监测。脊神经后根切断术对脑瘫患儿腰椎稳定性有一定影响,术后会出现腰椎过度前凸、椎骨脱离和脊椎滑脱等脊柱畸形,可有支气管痉挛、肺炎、尿潴留和感觉丧失等并发症[60—61](2个Ⅲ级证据)。

推荐

脊神经后根切断术是3—8岁、GMFCS Ⅲ—Ⅳ级下肢痉挛脑瘫治疗的一种选择,但应严格掌握适应证(推荐强度A级)。

三、巴氯芬鞘内注射

证据

巴氯芬鞘内注射(intrathecal baclofen therapy, IBT)对顽固性痉挛型脑瘫有效,可以抗痉挛,改善言语、交流和流涎控制能力,减少排便次数,对疼痛和运动障碍有积极影响,改善步态,改善常规抗痉挛治疗困难的脑瘫患儿坐轮椅时舒适程度,改善护理难度。巴氯芬鞘内注射治疗严重痉挛的患者、常规口服治疗难治的患者、混合型脑瘫患者是安全有效的[62—67](3个Ⅱ级证据,3个Ⅳ级证据)。巴氯芬鞘内注射治疗产生并发症的发病率为44%、继发感染率为73%,发生并发症并进行手术治疗率为31%。

推荐

巴氯芬鞘内注射是严重痉挛型脑瘫儿童治疗的一种选择(推荐强度C级)。

四、周围神经微创手术

证据

选择性周围神经切断术(胫神经、坐骨神经、肌皮神经、正中神经、尺神经、副神经、颈段和腰骶段脊神经前、后根)是治疗痉挛型脑瘫安全有效的手术方法,可降低肌张力、纠正痉挛性畸形、改善运动功能[68—69](2个Ⅳ级证据)。保守治疗无效的痉挛型脑瘫,选择性周围神经切断术可以缓解痉挛、改善功能[70—73](4个Ⅳ级证据)。选择性胫神经肌支切断术治疗脑瘫痉挛性马蹄内翻足,可降低肌张力。选择性股神经切断术可以改善股四头肌痉挛引起的膝关节僵硬,增加膝关节活动度。周围神经选择性切断术治疗下肢痉挛,部分患者出现肌力下降、肢体麻木。

肩外旋肌选择性神经切断术、C7神经根切断术、C8神经根切断术、背根神经节经皮射频毁损手术等周围神经微创手术的疗效缺乏有效的证据支持[74](1个Ⅳ级证据)。肩外旋肌选择性神经切断术可以缓解脑瘫患儿的肌肉痉挛;C7神经根切断、对侧健康C7神经根转移到患侧臂丛中干可以部分缓解脑瘫屈肌痉挛,增强伸肌力量;C8神经根切断术不能长期缓解脑瘫手部痉挛,痉挛治疗效果差[75](1个Ⅳ级证据)。严重髋屈曲/内收痉挛疼痛的脑瘫行背侧神经节经皮射频毁损手术,可以改善痉挛、疼痛,使护理更为容易[76](1个Ⅳ级证据)。

推荐

选择性周围神经部分切断术是保守治疗无效痉挛型脑瘫的治疗选择(推荐强度D级)。

参考文献

[1] Smeulders M, Coester A, Kreulen M. Surgical treatment for the thumb-in-palm deformity in patients with cerebral palsy[J]. Cochrane Database Syst Rev, 2005, 19(4): 004—093.

[2] Van Heest A, Stout J, Wervey R, et al. Follow-up motion laboratory analysis for patients with spastic hemiplegia due to cerebral palsy: analysis of the flexor carpi ulnaris firing pattern before and after tendon transfer surgery[J]. Hand Surg Am, 2010, 35(2): 284—290.

[3] Strecker WB, Emanuel JP, Dailey L, et al. Comparison of pronator tenotomy and pronator rerouting in children with spastic cerebral palsy[J]. Hand Surg Am, 1988, 13(4): 540—543.

[4] Watanabe K, Lenke LG, Daubs MD, et al. Is spine deformity surgery in patients with spastic cerebral palsy truly beneficial? a patient/parent evaluation[J]. Spine, 2009, 34(20): 2222—2232.

[5] Tsirikos AI, Mains E. Surgical correction of spinal deformity in patients with cerebral palsy using pedicle screw instrumentation[J]. Spinal Disord Tech, 2012, 25(7): 401—408.

[6] Sponseller PD, Shah SA, Abel MF, et al. Scoliosis surgery in cerebral palsy: differences between unit rod and custom rods[J]. Spine, 2009, 34(8): 840—844.

[7] Vande Velde S, Van Biervliet S, De Bruyne R, et al. Gastric dysmotility following orthopaedic scoliosis surgery in patients with cerebral palsy: a case series[J]. Neuropediatrics, 2010, 41(4): 182—185.

[8] Barrie JL, Galasko CS. Surgery for unstable hips in cerebral palsy[J]. Pediatr Orthop B, 1996, 5(4): 225—231.

[9] Kim HT, Jang JH, Ahn JM, et al. Early results of one-stage correction for hip instability in cerebral palsy[J]. Clin Orthop Surg, 2012, 4(2): 139—148.

[10] Dhawale AA, Karatas AF, Holmes L, et al. Long-term outcome of reconstruction of the hip in young children with cerebral palsy [J]. Bone Joint J, 2013, 95(2): 259—265.

[11] Canavese F, Gomez H, Kaelin A, et al. Percutaneous pelvic osteotomy and intertrochanteric varus shortening osteotomy in nonambulatory GMFCS level IV and V cerebral palsy patients: preliminary report on 30 operated hips[J]. Pediatr Orthop B, 2013, 22(1): 1—7.

[12] Kay RM, Rethlefsen S, Reed M, et al. Changes in pelvic rotation after soft tissue and bony surgery in ambulatory children with cerebral palsy[J]. Pediatr Orthop, 2004, 24(3): 278—282.

[13] McNerney NP, Mubarak SJ, Wenger DR. One-stage correction of the dysplastic hip in cerebral palsy with the San Diego acetabuloplasty: results and complications in 104 hips[J]. J Pediatr Orthop, 2000, 20(1): 93—103.

[14] Raphael BS, Dines JS, Akerman M, et al. Long-term followup of total hip arthroplasty in patients with cerebral palsy[J]. Clin Orthop Relat Res, 2010, 468(7): 1845—1854.

[15] Zarrinkalam R, Rice J, Brook P, et al. Hip displacement and overall function in severe cerebral palsy[J]. Pediatr Rehabil Med, 2011, 4(3): 197—203.

[16] Wright PB, Ruder J, Birnbaum MA, et al. Outcomes after salvage procedures for the painful dislocated hip in cerebral palsy[J]. Pediatr Orthop, 2013, 33(5): 505—510.

[17] Noonan KJ, Walker TL, Kayes KJ, et al. Effect of surgery on the nontreated hip in severe cerebral palsy[J]. Pediatr Orthop, 2000, 20(6): 771—775.

[18] Morton RE, Scott B, McClelland V, et al. Dislocation of the hips in children with bilateral spastic cerebral palsy, 1985-2000[J]. Dev Med Child Neurol, 2006, 48(7): 555—558.

[19] 王秋根, 吴岳嵩, 年申生, 等. 选择性脊神经后根切断及软组织手术对痉挛性脑瘫的治疗[J]. 中华小儿外科杂志, 1998, 19(3): 162—164.
[20] 张雪非, 陈道运. 内收短肌和股薄肌移位术治疗脑瘫剪刀步[J]. 中华骨科杂志, 2006, 26(1): 21—25.
[21] Yngve DA, Scarborough N, Goode B, et al. Rectus and hamstring surgery in cerebral palsy: a gait analysis study of results by functional ambulation level[J]. Pediatr Orthop, 2002, 22(5): 672—676.
[22] Ounpuu S, Muik E, Davis RB 3rd, et al. Rectus femoris surgery in children with cerebral palsy. Part II: A comparison between the effect of transfer and release of the distal rectus femoris on knee motion[J]. Pediatr Orthop, 1993, 13(3): 331—335.
[23] McMulkin ML, Baird GO, Barr KM, et al. Proximal rectus femoris release surgery is not effective in normalizing hip and pelvic variables during gait in children with cerebral palsy[J]. J Pediatr Orthop, 2005, 25(1): 74—78.
[24] Rethlefsen SA, Kam G, Wren TA, et al. Predictors of outcome of distal rectus femoris transfer surgery in ambulatory children with cerebral palsy[J]. J Pediatr Orthop B, 2009, 18(2): 58—62.
[25] Park MS, Chung CY, Lee SH, et al. Effects of distal hamstring lengthening on sagittal motion in patients with diplegia: hamstring length and its clinical use[J]. Gait Posture, 2009, 30(4): 487—491.
[26] Ma FY, Selber P, Nattrass GR, et al. Lengthening and transfer of hamstrings for a flexion deformity of the knee in children with bilateral cerebral palsy: technique and preliminary results[J]. J Bone Joint Surg Br, 2006, 88(2): 248—254.
[27] Kay RM, Rethlefsen SA, Skaggs D, et al. Outcome of medial versus combined medial and lateral hamstring lengthening surgery in cerebral palsy[J]. J Pediatr Orthop, 2002, 22(2): 169—172.
[28] Lin CL, Lin CJ, Huang MT, et al. Mesh Achilles tendon lengthening--a new method to treat equinus deformity in patients with spastic cerebral palsy: surgical technique and early results[J]. J Pediatr Orthop B, 2013, 22(1): 14—19.
[29] 袁仙, 桃彭昊, 钟俊. Hoke跟腱滑动延长术治疗小儿脑瘫痉挛型马蹄足[J]. 中华小儿外科杂志, 1999, 20(2): 109—110.
[30] Dietz FR, Albright JC, Dolan L. Medium-term follow-up of Achilles tendon lengthening in the treatment of ankle equinus in cerebral palsy[J]. Iowa Orthop J, 2006, 26: 27—32.
[31] Vlachou M, Pierce, Davis RM, et al. Does tendon lengthening surgery affect muscle tone in children with cerebral palsy[J]. Acta Orthop Belg, 2009, 75(6): 808—814.
[32] Tylkowski CM, Horan M, Oeffinger DJ. Outcomes of gastrocnemius-soleus complex lengthening for isolated equinus contracture in children with cerebral palsy[J]. J Pediatr Orthop, 2009, 29(7): 771—778.
[33] Bourelle S, Cottalorda J, Gautheron V, et al. Extra-articular subtalar arthrodesis. A long-term follow-up in patients with cerebral palsy[J]. J Bone Joint Surg Br, 2004, 86(5): 737—742.
[34] Mazis GA, Sakellariou VI, Kanellopoulos AD, et al. Results of extra-articular subtalar arthrodesis in children with cerebral palsy[J]. Foot Ankle Int, 2012, 33(6): 469—474.
[35] Yoon HK, Park KB, Roh JY, et al. Extraarticular subtalar arthrodesis for pes planovalgus: an interim result of 50 feet in patients with spastic diplegia[J]. Clin Orthop Surg, 2010, 2(1): 13—21.
[36] Engström A, Erikson V, Hjelmstedt A. The results of extra-articular subtalar arthrodesis according to the green-grice method in cerebral palsy[J]. Acta Orthop Scand, 1974, 45(6): 945—951.
[37] Leidinger B, Heyse TJ, Fuchs-Winkelmann S, et al. Grice-Green procedure for severe hindfoot valgus in ambulatory patients with cerebral palsy[J]. Foot Ankle Surg, 2011, 50(2): 190—196.
[38] Shore BJ, Smith KR, Riazi A, et al. Subtalar fusion for pes valgus in cerebral palsy: results of a modified technique in the setting of single event multilevel surgery[J]. Pediatr Orthop, 2013, 33(4): 431—438.
[39] Bernthal NM, Gamradt SC, Kay RM, et al. Static and dynamic gait parameters before and after multilevel soft tissue surgery in ambulating children with cerebral palsy[J]. Pediatr Orthop, 2010, 30(2): 174—179.
[40] Lee KM, Chung CY, Park MS, et al. Level of improvement determined by PODCI is related to parental satisfaction after single-event multilevel surgery in children with cerebral palsy[J]. Pediatr Ortho, 2010, 30(4): 396—402.
[41] Thomason P, Baker R, Dodd K, et al. Single-event multilevel surgery in children with spastic diplegia: a pilot randomized controlled trial[J]. Bone Joint Surg Am, 2011, 93(5): 451—460.
[42] Harvey A, Rosenbaum P, Hanna S, et al. Longitudinal changes in mobility following single-event multilevel surgery in ambulatory children with cerebral palsy[J]. J Rehabil Med, 2012, 44(2): 137—143.
[43] Godwin EM, Spero CR, Nof L, et al. The gross motor function classification system for cerebral palsy and single-event multilevel surgery: is there a relationship between level of function and intervention over time?[J]. Pediatr Orthop, 2009, 29(8): 910—915.
[44] Koca K, Yıldız C, Yurttaş Y, et al. Outcomes of multilevel orthopedic surgery in children with cerebral palsy[J]. Eklem Hastalik Cerrahisi, 2011, 22(2): 69—74.
[45] Cuomo AV, Gamradt SC, Kim CO, et al. Health-related quality of life outcomes improve after multilevel surgery in ambulatory children with cerebral palsy[J]. Pediatr Orthop, 2007, 27(6): 653—657.
[46] Park MS, Chung CY, Lee SH, et al. Issues of concern after a single-event multilevel surgery in ambulatory children with cerebral palsy[J]. Pediatr Orthop, 2009, 29(7): 765—770.
[47] Svehlík M, Steinwender G, Kraus T, et al. The influence of age at single-event multilevel surgery on outcome in children with cerebral palsy who walk with flexed knee gait[J]. Dev Med Child Neurol, 2011, 53(8): 730—735.
[48] Rutz E, Baker R, Tirosh O, et al. Are results after single-event multilevel surgery in cerebral palsy durable[J]. Clin Orthop Relat

Res, 2013, 471(3): 1028—1038.
[49] Smitherman JA, Davids JR, Tanner S, et al. Functional outcomes following single-event multilevel surgery of the upper extremity for children with hemiplegic cerebral palsy[J]. Bone Joint Surg Am, 2011, 93(7): 655—661.
[50] McLaughlin J, Bjornson K, Temkin N, et al. Selective dorsal rhizotomy: meta-analysis of three randomized controlled trials[J]. Dev Med Child Neurol, 2002, 44(1): 17—25.
[51] Kan P, Gooch J, Amini A, et al. Surgical treatment of spasticity in children: comparison of selective dorsal rhizotomy and intrathecal baclofen pump implantation[J]. Childs Nerv Syst, 2008, 24(2): 239—243.
[52] van Schie PE, Schothorst M, Dallmeijer AJ, et al. Short- and long-term effects of selective dorsal rhizotomy on gross motor function in ambulatory children with spastic diplegia[J]. Neurosurg Pediatr, 2011, 7(5): 557—562.
[53] Tedroff K, Löwing K, Jacobson DN, et al. Does loss of spasticity matter A 10-year follow-up after selective dorsal rhizotomy in cerebral palsy[J]. Dev Med Child Neurol, 2011, 53(8): 724—729.
[54] Oki A, Oberg W, Siebert , et al. Selective dorsal rhizotomy in children with spastic hemiparesis[J]. Neurosurg Pediatr, 2010, 6(4): 353—358.
[55] Kim DS, Choi JU, Yang KH, et al. Selective posterior rhizotomy for lower extremity spasticity: how much and which of the posterior rootlets should be cut[J]. Surg Neurol, 2002, 57(2): 87—93.
[56] Grunt S, Henneman WJ, Bakker MJ, et al. Effect of selective dorsal rhizotomy on gait in children with bilateral spastic paresis: kinematic and EMG-pattern changes[J]. Neuropediatrics, 2010, 41(5): 209—216.
[57] Grunt S, Becher JG, Vermeulen RJ. Long-term outcome and adverse effects of selective dorsal rhizotomy in children with cerebral palsy: a systematic review[J]. Dev Med Child Neurol, 2011, 53(6): 490—498.
[58] Kim HS, Steinbok P, Wickenheiser D. Predictors of poor outcome after selective dorsal rhizotomy in treatment of spastic cerebral palsy[J]. Childs Nerv Syst, 2006, 22(1): 60—66.
[59] Ailon T, Beauchamp R, Miller S, et al. Long-term outcome after selective dorsal rhizotomy in children with spastic cerebral palsy [J]. Childs Nerv Syst, 2015, 31(3):415—423.
[60] Mittal S, Farmer JP, Al-Atassi B, et al. Long-term functional outcome after selective posterior rhizotomy[J]. J Neurosurg, 2002, 97 (2): 315—325.
[61] Langerak NG, Lamberts RP, Fieggen AG, et al. A prospective gait analysis study in patients with diplegic cerebral palsy 20 years after selective dorsal rhizotomy[J]. Neurosurg Pediatr, 2008, 1(3): 180—186.
[62] Hoving MA, van Raak EP, Spincemaille GH, et al. Safety and one-year efficacy of intrathecal baclofen therapy in children with intractable spastic cerebral palsy[J]. Eur J Paediatr Neurol, 2009, 13(3): 247—256.
[63] Francisco GE, Saulino MF, Yablon SA, et al. Intrathecal baclofen therapy: an update[J]. PMR, 2009, 1(9): 852—858.
[64] Brochard S, Remy-Neris O, Filipetti P, et al. Intrathecal baclofen infusion for ambulant children with cerebral palsy[J]. Pediatr Neurol, 2009, 40(4): 265—270.
[65] Rivera DR, Arcila LM, Campuzano ED. Intrathecal baclofen for the treatment of spasticity. Case report with thematic review[J]. Rev Colomb Anesthesiol, 2013, 41(3): 2292—2350.
[66] Murphy NA, Irwin MC, Hoff C. Intrathecal baclofen therapy in children with cerebral palsy: efficacy and complications[J]. Arch Phys Med Rehabil, 2002, 83(12): 1721—1715.
[67] Borowski A, Littleton AG, Borkhuu B, et al. Complications of intrathecal baclofen pump therapy in pediatric patients[J]. Pediatr Orthop, 2010, 30(1): 76—81.
[68] 于炎冰, 张黎, 马延山, 等. 1244例痉挛状态的显微神经外科手术治疗[J]. 中华神经外科杂志, 2005, 21(9): 542—545.
[69] 王世杰, 陈业涛, 刘海生, 等. 儿童痉挛型脑性瘫痪的神经外科治疗[J]. 中华神经外科杂志, 2008, 24(6): 422—424.
[70] Msaddi AK, Mazroue AR, Shahwan S, et al. Microsurgical selective peripheral neurotomy in the treatment of spasticity in cerebral-palsy children[J]. Stereotact Funct Neurosurg, 1997, 69(4): 251—258.
[71] Maarrawi J, Mertens P, Luaute J, et al. Long-term functional results of selective peripheral neurotomy for the treatment of spastic upper limb: prospective study in 31 patients[J]. Neurosurg, 2006, 104(2): 215—225.
[72] Xu WD, Hua XY, Zheng MX, et al. Contralateral C7 nerve root transfer in treatment of cerebral palsy in a child: case report[J]. Microsurgery, 2011, 31(5): 404—408.
[73] Wangjam KB, Joy Singh AK, Romi Singh N, et al. EMG guided selective tibial neurectomy in reduction of gastro-soleus spasticity - its role in the treatment of cerebral palsy[J]. IJPMR, 2001, 12:1—5.
[74] Fitoussi F, Ilharreborde B, Presedo A, et al. Shoulder external rotator selective neurotomy in cerebral palsy: anatomical study and preliminary clinical results[J]. J Pediatr Orthop B, 2010, 19(1): 71—76.
[75] Lin H, Hou C, Chen A, et al. Long-term outcome of division of the C8 nerve root for spasticity of the hand in cerebral palsy[J]. Hand Surg Eur Vol, 2010, 35(7): 558—562.
[76] Vles GF, Vles JS, van Kleef M, et al. Percutaneous radiofrequency lesions adjacent to the dorsal root ganglion alleviate spasticity and pain in children with cerebral palsy: pilot study in 17 patients[J]. BMC Neurol, 2010, 10(3): 52.

（本节编写人员：杜 青）