

·指南·共识·解读·

腹直肌鞘阻滞中国专家共识(2023版)

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【摘要】 神经阻滞是术后多模式镇痛的重要组成部分,腹直肌鞘阻滞是临床常用的神经阻滞方法之一,主要阻滞肋间神经的前皮支,对腹部中线切口具有明确的镇痛效果,同时在疼痛诊疗中也有良好的应用。本专家共识介绍了腹直肌鞘阻滞的相关解剖结构、阻滞方法、常用药物、并发症以及临床应用等,供指导临床应用。

【关键词】 腹直肌; 神经传导阻滞; 专家共识

DOI: 10.3760/cma.j.cn101658-20220825-00204

Expert consensus on rectus sheath block in China (2023 edition)

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【Abstract】 Nerve block is an important part of postoperative multimodal analgesia. Rectus sheath block is one of the commonly used nerve block methods in clinical practice, which mainly blocks the anterior cutaneous branch of intercostal nerves. This method has a clear analgesic effect on midline abdominal incision, and has a good application in pain diagnosis and treatment. This expert consensus introduces the related anatomical structure, blocking method, commonly used drugs, complications and clinical application of rectus sheath block in order to guide the clinical practice.

【Key words】 Rectus abdominis; Nerve block; Expert consensus

DOI: 10.3760/cma.j.cn101658-20220825-00204

概 述

腹直肌鞘阻滞(rectus sheath block, RSB)是将局麻药注入腹直肌与腹直肌后鞘之间,阻滞走行于两者之间的神经,为正中前腹壁切口的腹膜、肌肉、皮肤提供镇痛的技术。1899年, Schleich首次将其应用于松弛成年人前腹壁,但这项技术并未受到重视,临床应用也较少。1988年, Smith等^[1]发表的文章应用这项技术为诊断性腹腔镜检查术提供术中及术后镇痛,结果显示, RSB组显著减少了术后疼痛,满足了至少10 h的镇痛需求。1996年, Ferguson等^[2]将RSB其用于小儿脐疝修补术镇痛,取得了良好的效果。受制于如何避免腹腔穿刺的技术难题,这项技术难以在临床普遍开展。2006年, Willschke等^[3]率先提出在超声引导下下行RSB,取得了良好的效果,使这项技术重新焕发生机。2009年, Dolan等^[4]做了由实习麻醉科医师使用阻力消失法或超声引导的RSB准确性对比的研究。结果显示在首次注射时, 89%的患者在超声引导下成功注射了局麻药,而在阻力消失组中,仅45%的腹部穿刺正确注射局麻药。这些发现证实了RSB使用超声引导的价值。此后多项

研究^[5-10]显示超声引导下RSB可以明显减少阿片类药物的使用,减少恶心、肠梗阻和嗜睡;下肢没有运动障碍,患者可及早下地活动;有助于尽早拔除导尿管,并且易于操作,安全性高,并发症少。2017年, Miyazaki等^[11]报道了一种新型的技术,腹腔镜下行RSB。行腹腔镜脐疝修复时,脐伤口闭合后,从其他端口通过腹腔镜检查脐,通过皮肤在腹直肌和后鞘之间的4个部位(双侧脐上下各3 cm)注射局麻药,使用22 G针头分次注射10 ml 0.25%左旋布比卡因(总计40 ml),注射时目测到后鞘肿胀,术后镇痛效果良好,此为RSB提供了一个新的思路。2016年美国区域麻醉和疼痛医学学会给予超声引导下RSB, A级证据I b推荐^[12]。近年来随着超声设备的发展和穿刺技术的成熟, RSB在临床多模式镇痛中受到重视。

解剖学特点

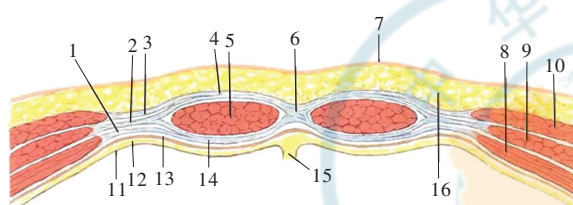
腹直肌鞘位于腹前壁,由腹外侧壁三块扁肌的腱膜构成,分前、后两层包绕腹直肌^[13]。腹横肌平面和腹直肌鞘均位于腹壁。

一、腹直肌鞘的局部解剖

腹直肌鞘位于腹前壁,为包裹腹直肌、锥状肌的

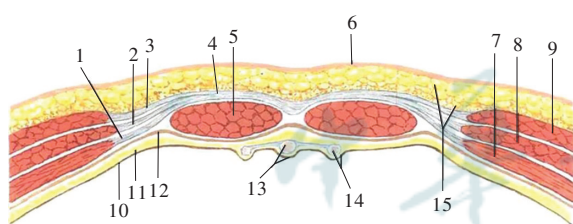


致密且不完全的结缔组织鞘,鞘内除两条直肌外,其他内容物有 $T_7 \sim T_{12}$ 神经的前皮支、淋巴管、腹壁上动脉和静脉、腹壁下动脉和静脉。腹直肌鞘由腹外斜肌、腹内斜肌和腹横肌的腱膜构成(图1~3),可分为前、后两层,前层由腹外斜肌腱膜和腹内斜肌腱膜的前层构成,后层由腹内斜肌腱膜的后层和腹横肌腱膜构成。在脐与耻骨联合连线中点(脐以下4~5 cm),3层扁肌的腱膜均参与构成腹直肌鞘前层,后层缺如,形成一弯向下的弓状游离缘,称弓状线(半环线)。弓状线以下腹直肌后面紧贴腹横筋膜。 $T_7 \sim T_{11}$ 肋间神经和肋下神经前皮支从腹横肌平面穿出后,向内走行于腹直肌和腹直肌后鞘之间,从正中中线两旁穿出^[14]。



注:腹直肌鞘前层由腹外斜肌腱膜和腹内斜肌腱膜的前层构成,后层由腹内斜肌腱膜的后层和腹横肌腱膜构成;图中1为腹横肌腱膜,2为腹内斜肌腱膜,3为腹外斜肌腱膜,4为腹直肌鞘前层,5为腹直肌,6为白线,7为皮肤,8为腹横肌,9为腹内斜肌,10为腹外斜肌,11为腹膜,12为腹膜外筋膜,13为腹横筋膜,14为腹直肌鞘后层,15为镰状韧带,16为皮下组织(脂肪层)

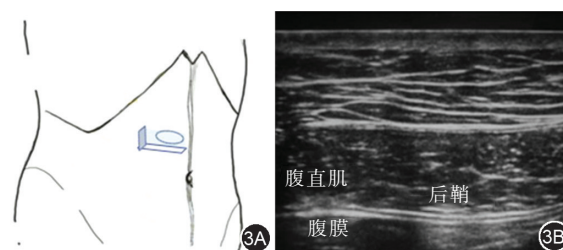
图1 弓状线以上腹直肌鞘的构成^[15]



注:腹直肌鞘前层由腹外斜肌腱膜、腹内斜肌腱膜和腹横肌腱膜构成,腹直肌后面紧贴腹横筋膜;图中1为腹横肌腱膜,2为腹内斜肌腱膜,3为腹外斜肌腱膜,4为腹直肌鞘前层,5为腹直肌,6为皮肤,7为腹横肌,8为腹内斜肌,9为腹外斜肌,10为腹膜,11为腹膜外筋膜,12为腹横筋膜,13为脐正中列内的脐正中韧带(闭锁的脐尿管),14为脐内侧韧带及内侧裂,15为皮下组织(脂肪和膜性层)

图2 弓状线以下腹直肌鞘的构成^[15]

有研究表明,在高达30%的人群中,肋间神经的前皮支在进入腹直肌鞘外侧缘之前形成,这部分人群的前皮支不穿透腹直肌鞘的后壁,而是在皮下组织中延伸到腹直肌的前方^[17]。为了减少这种解剖差异可能带来的阻滞失效,可以在腹直肌后鞘和皮下分别注药,或进入腹直肌鞘之前,在腹内斜肌腱



注:图3A中的灰色盒子代表B超探头在弓状线以上腹直肌处的放置位置;图3B为B超探头放置在灰色盒子处所采集的B超图像,黄色虚线为腹直肌后鞘,红色虚线为腹膜

图3 腹直肌鞘超声图像^[16]

膜和腹横肌之间进行注药。另有研究表明,从 $T_8 \sim T_{11}$ 的所有肋间神经均在腹直肌外侧缘穿腹直肌鞘,并在腹直肌后方走行约5 cm后进入肌肉(偶尔在外侧缘进入腹直肌)^[18-19]。肋间神经的前皮支走行与腹直肌鞘的关系可能存在解剖变异,或同一患者可能存在双侧变异,阻滞时需考虑这些变异的影响。

二、腹直肌鞘的阻滞范围

腹直肌位于腹正中两侧,被腹直肌鞘包裹。腹直肌鞘阻滞范围主要为 $T_7 \sim T_{12}$ 的前皮支。由于药物无法向外侧扩散,腹直肌鞘阻滞只适用于腹部正中切口和经腹直肌切口的手术镇痛^[20]。可通过超声检查确定腹直肌的外侧边界(半月线),半月线内 $T_7 \sim T_{12}$ 前皮支的分布区域为可及的阻滞范围(图4)。

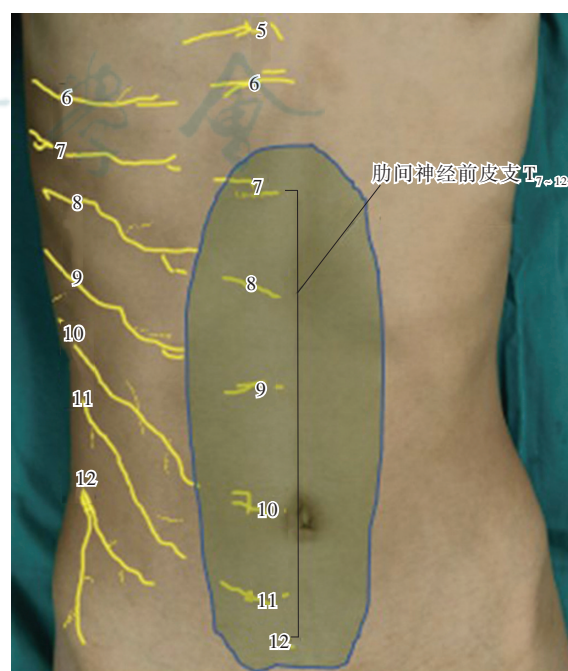


图4 腹直肌鞘阻滞范围示意图

常用阻滞药物

临床上RSB常用的局部麻醉药物有罗哌卡因^[21-24]、布比卡因^[25-26]、左旋布比卡因^[27]、利多卡因^[25],这些药物均为酰胺类局麻药。被用作周围神经阻滞的局麻药,其药代动力学尚未得到充分研究,阻滞方式不同可有差异。有研究显示,2.5 mg/kg左旋布比卡因用于RSB单次注射时,腹横肌平面阻滞(transversus abdominis plane block, TAPB)组平均最大血药浓度(C_{max})和平均达到C_{max}时间(T_{max})分别为1.05 μg/ml和32.4 min,RSB组为0.95 μg/ml和60.9 min,左旋布比卡因血药浓度在RSB组比TAPB组达到峰值的时间晚,最大血药浓度与给药剂量有关^[28]。另有研究显示罗哌卡因用于RSB组的血药浓度达峰时间也是TAPB组的两倍^[29]。这可能提示RSB后需要一个更长的观察期,以预防局麻药的毒性反应发生。RSB局部麻醉的部分病例可检测到全身浓度超过局麻药全身毒性的公认阈值,其中仅有少数患者出现轻度不良反应,肾上腺素的加入可减少局麻药的全身毒性^[30]。

目前,临床上RSB时还没有公认的最佳给药浓度和剂量,也未发现超声引导RSB使用局麻药种类、浓度和容量的系统性对比研究。由于腹直肌鞘内神经在超声下不易分辨,常需较大容量的局麻药才能获得良好的镇痛效果。成年患者,文献报道RSB局麻药的使用剂量为每侧10~15 ml时^[22,31-34],能取得良好镇痛效果无显著药物相关不良反应。使用罗哌卡因、布比卡因、左旋布比卡因行RSB时多使用0.25~0.5%的浓度^[21]。儿童患者行RSB时,0.2%罗哌卡因每侧0.5 ml/kg(最大10 ml)^[35]、0.25%布比卡因每侧0.25 ml/kg^[26]、0.25%罗哌卡因每侧0.5 ml/kg^[36]、0.375%罗哌卡因每侧0.2 ml/kg^[37]可观察到良好的镇痛效果。儿童肝肾功能不成熟,血浆蛋白结合水平低,使儿童患者对局麻药的代谢能力受到限制。研究^[38]显示儿童局部浸润麻醉需要平均剂量0.8 ml/kg的布比卡因,对于RSB,只需要几乎一半的剂量(0.44 ml/kg)就可以达到相同的镇痛效果。Meta分析^[39]选取了8项针对儿童的随机临床试验和回顾性研究,0.2%~0.5%浓度下的局麻药剂量范围为0.5~2.5 ml/kg,0.25%浓度的罗哌卡因对术后24 h镇痛效果最佳,其低浓度(0.2%)无效,而高浓度(0.375%)可增加全身毒性的风险,且大多数纳入的研究使用

0.25%的布比卡因浓度和2.5 mg/kg的剂量可以有效降低疼痛评分。

固定剂量的局麻药在腹直肌鞘内的填充扩散与腹直肌鞘的大小成反比,因此,在实施RSB时,局麻药的剂量应根据患者的体重指数(body mass index, BMI)进行调整,同时考虑允许的局麻药最大剂量。当双侧TAPB联合RSB时,需合理分配各穿刺点局麻药剂量,警惕局麻药剂量过量导致局麻药毒性反应^[26]。

局麻药中添加佐剂可能增强RSB的镇痛效果,延长阻滞时间,满足多模式镇痛的要求。如右美托咪定联合罗哌卡因被报道用于老年腹股沟直疝修补术^[22]和行腹部手术的老年高危患者^[23]。年龄10~17岁的患者接受腹腔镜阑尾切除术时,罗哌卡因加用可乐定对RSB持续时间无明显延长作用^[40]。Patzkowski等^[41]报道了长效布比卡因脂质体用于RSB,可以减轻术后72 h的疼痛控制,加速患者恢复。

RSB的镇痛效果与RSB的给药方式有关。有三种不同的RSB给药方法,即单次给药、重复剂量给药^[42]和持续给药^[43-44],后两者可通过留置双侧腹直肌鞘导管实施。比较三种方式,重复剂量RSB镇痛可增强剖腹中线切口术后的疼痛缓解和患者满意度,每4 h重复10 ml或连续输注5 ml/h左旋布比卡因1.25 mg/ml是可行的选择^[9]。

阻滞方法

一、体表解剖标记和定位方法

穿刺点一般位于剑突与脐之间。腹直肌后鞘和覆盖腹直肌后表面的肌外膜之间的低回声空间是本阻滞的目标平面。

二、无影像学引导阻滞方法(传统盲法入路)

操作时患者取仰卧位,触诊腹直肌外侧缘,从腹直肌外侧缘进针,穿刺针刺破皮肤后,达到腹直肌前鞘时会有阻力感,刺破前鞘后会有落空感,继续在腹直肌内进针,当遇到第2次阻力时表明达到腹直肌后鞘,回抽无血后注药。

三、超声引导阻滞方法

1. 超声探头推荐 通常使用高频线阵探头。

2. 超声引导方法 探头横向垂直放置在白线旁(图5)。超声图像上腹直肌的短轴图像为椭圆形低回声结构,被高亮回声的腱膜包裹,腹直肌后鞘游离

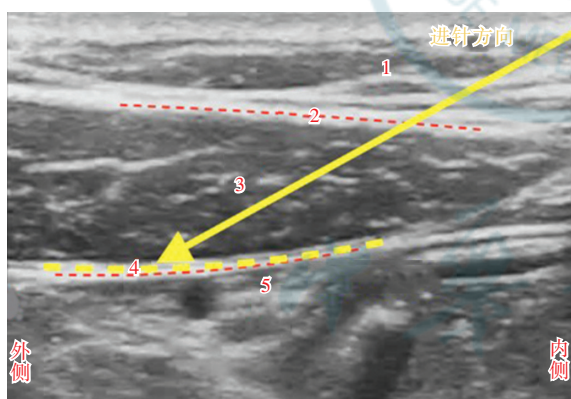


贴附于腹直肌深面,后鞘的深面是高亮的壁层腹膜。采用彩色多普勒模式来识别腹壁动脉,避免穿破血管。采用平面内技术进针,经过皮下组织,穿过腹直肌前鞘后继续进针,穿过肌肉直到针尖到达腹直肌后鞘,腹直肌腱膜与腹直肌后鞘之间的筋膜平面就是注药部位。回抽注射器无血无气后,缓慢注射1~2 ml局麻药以确定针尖位置。确定后注射药物,超声下可见腹直肌与腹直肌后鞘分离,药物在腹直肌后鞘浅层呈梭形扩散^[45]。见图6。



注:高频线阵探头横向垂直放置在白线旁,上下滑动探头扫查,探头标记点P朝向患者外侧

图5 腹直肌鞘阻滞时超声探头放置位置



注:图中左侧为外侧,1为皮下组织,2为腹直肌前鞘,3为腹直肌,4为腹直肌后鞘,5为腹膜;黄色箭头为进针方向,由内侧指向外侧,采用平面内技术进针,针尖到达腹直肌后鞘,黄色虚线为注药部位,即腹直肌腱膜与腹直肌后鞘之间的筋膜平面,可见腹直肌与腹直肌后鞘分离,药物成梭形扩散;注意回抽无血无气后再推注阻滞药物

图6 腹直肌鞘阻滞对应的超声图像、进针路线及药液注射部位

3. 阻滞范围 腹壁正中及脐区($T_7 \sim T_{12}$),适用于脐部及腹部正中切口手术^[46]。

效果判断

注射局麻药后10~15 min,对神经所支配区域

进行感觉评估。

1. 询问患者是否出现腹壁皮肤感觉麻木,如存在麻木感,则说明阻滞成功;

2. 用湿酒精拭子擦拭腹壁皮肤及对侧手臂,询问患者是否存在温度觉的差异,如存在,则说明阻滞成功;

3. 用钝针轻刺腹壁皮肤,询问患者是否存在痛感,如刺痛明显为3分;刺痛敏感性减弱为2分;有刺痛感但不明显为1分;刺痛消失为0分。以针刺皮肤痛感消失、触觉存在为部分阻滞;痛感、触觉完全消失为完全阻滞^[47]。

并发症及注意事项

一、并发症及其防治

RSB具有良好的安全性,腹部脏器的损伤和局麻药的毒性反应是常见的并发症。由于腹直肌前缘存在肌筋膜插入点,限制了局麻药向前面扩散,会导致局麻药分布不均。行RSB时,如果穿刺时针的位置比较靠近腹膜和腹壁动脉,盲穿时则有误穿腹膜和血管的危险。两篇研究^[4,48]发现RSB阻滞后的并发症包括腹腔注射和腹膜后血肿,阻滞均采用的阻力消失法。随着在超声引导下进行此操作,可使并发症最小化^[49]。因此,行RSB阻滞时,尽量在超声引导下进行,穿刺时特别注意反复回抽,并观察回抽时有无血液,以避免局麻药误入血管。

二、注意事项

1. 阻滞前严格把握适应证和禁忌证,与患者或家属充分沟通,取得其配合,告知患者阻滞可能会出现不良反应及并发症,并在知情同意书上签字;开放患者静脉通道,做好监护并准备好抢救药品与设备。

2. 操作者应接受过RSB规范化的技能培训和实践,熟知阻滞部位的解剖特点及相邻组织器官解剖关系,避免损伤邻近的神经、血管及脏器。

3. 阻滞应在治疗室或手术室进行,操作全程注意无菌,避免穿刺部位感染。

4. 阻滞过程中与患者沟通,如有局麻药中毒的表现,需及时抢救。阻滞后观察15~20 min,如出现任何不适,及时处理。

5. 反复穿刺有可能损伤血管、神经、腹腔脏器,建议尽可能在超声引导下进行^[49],进针过程中超声必须全程观察到穿刺针尖的位置。



临床应用

RSB广泛应用于腹部手术的术后镇痛,对于腹部体表手术也可作为一种单独的麻醉方法,是疼痛治疗的一种有效手段。目前在胃肠、肝胆、剖宫产、腹股沟疝修补、脐疝修补等手术应用较多,RSB还可用于前皮神经卡压综合征、慢性腹痛及带状疱疹后神经痛的治疗。

一、RSB在临床麻醉中的应用

RSB对腹壁前正中切口的腹膜、肌肉和皮肤提供镇痛,可为脐周围的切口提供良好的镇痛效果。双侧RSB是一些浅表脐周手术如开放脐疝修补术的单一麻醉技术^[25]。RSB可用于成人计划行脐疝修补术的日间手术患者,在 T_{10} 水平,每侧注入0.375%的左旋布比卡因20 ml时,53%的成人脐疝患者能完成脐疝修补手术^[27],不辅用镇静、镇痛全麻药或仅在切口处补充局麻药,牵引或深部组织如疝囊、大网膜处操作引起疼痛不适时可辅用少量镇静镇痛药。双侧RSB可以避免高危脐疝患者行全身麻醉和椎管内麻醉可能带来的呼吸和循环波动。RSB局麻药扩散范围达 $T_9 \sim T_{11}$ 时阻滞效果更完善。RSB联合TAPB可用于腹膜透析置管术的麻醉,在没有其他辅助麻醉药的情况下成功阻滞,此类患者肾功能衰竭,常合并糖尿病、高血压及严重的心肺疾病^[50]。

RSB主要提供躯体镇痛,可作为围术期多模式镇痛方案的一部分,在围术期广泛应用^[10,51]。如腹腔镜下妇科手术、腹腔镜阑尾切除术、膀胱癌根治术、腹腔镜下腹股沟斜疝修补、经腹膜腹腔镜下供体肾切除术、开放胃切除术^[22,34,52-55]等,还可以用于幼儿腹部手术后镇痛,特别是脐疝修补术^[26]。RSB可降低成人接受腹腔镜手术后0~2 h和10~12 h的静息痛评分、术后0~2 h运动疼痛评分,亦降低术后2 h、24 h阿片类药物摄入及阿片类药物相关不良反应发生率^[10]。但RSB单次注药对术后超过24 h的疼痛作用有限,可能与使用局麻药如罗哌卡因、布比卡因的半衰期(8~10 h)有关^[54]。一项非劣效性随机对照试验^[44],连续RSB与连续硬膜外麻醉对妇科癌症手术患者镇痛效果的比较,上达经肚脐上方5 cm处的正中切口,术后静息痛两者相当。连续硬膜外镇痛作为术后多模式镇痛存在禁忌时,对于腹部正中切口手术,连续RSB可以是一种替代方法。

联合其他阻滞方式可用于更广泛的腹部手术围

术期多模式镇痛,减少阿片类镇痛药术中及术后用量,维持血液动力学稳定,无下肢运动无力及尿滞留。如TAPB联合RSB可提供更加完善的腹壁神经阻滞效果,用于腹腔镜胰十二指肠切除术^[56]、脾切除术^[57]、腹腔镜直肠癌根治术^[32]、肝脏手术^[58]等;右侧前锯肌-肋间平面阻滞联合双侧RSB可用于腹腔镜下胆囊切除术后镇痛^[31];此外还有腰方肌阻滞联合RSB、胸椎旁阻滞联合RSB、髂腹下髂腹股沟神经阻滞联合RSB等。

RSB是多模式镇痛技术之一,但选择合适的技术应该基于对时间、成本和设施等综合考虑。对于一些创伤较小的微创日间手术,0.25%罗哌卡因RSB与0.5%罗哌卡因局麻浸润用于儿童单切口腹腔镜腹股沟疝修补术,超声下RSB使用0.5 ml/kg 0.25%罗哌卡因(每侧)是有效的;但相较于切口局部浸润麻醉使用0.4 ml/kg更高浓度0.5%罗哌卡因镇痛效果未表现出优势^[36]。类似的研究亦见于腹腔镜下胆囊切除术^[33]。

除了经超声引导RSB,还有外科医生经切口的RSB和腹腔镜引导的RSB用于围术期镇痛,前者在缝合之前从切开的切口将局麻药注射至腹直肌鞘,后者经皮注射腹腔内腹腔镜可视化辅助至腹直肌鞘^[35,52]。

二、RSB在疼痛治疗中的应用

1. 前皮神经卡压综合征(anterior cutaneous nerve entrapment syndrome, ACNES)的辅助诊断 该综合征可见于各年龄段,女性多见。腹部疼痛是主要症状,呈锐痛、钝痛或烧灼样疼痛。疼痛主要位于腹直肌的外侧,沿肋骨、腰腹部向后背、后腰辐射,可出现皮肤感觉改变,包括感觉减退、痛觉过敏^[59]。腹部疼痛可分为内脏、腹壁或功能性疼痛。由于医生倾向于关注患者的内脏,腹壁作为疼痛来源常常被忽视。儿童腹壁疼痛的鉴别诊断包括疝、肌筋膜损伤、肿瘤和神经痛。与其他病因相比,前皮神经卡压引起的神经痛不能通过影像学或实验室检查来诊断,导致前皮神经卡压引起的慢性腹部疼痛常常被忽略。13%患有慢性腹痛的儿童存在ACNES。更有估计多达30%的腹痛来源于腹壁疼痛。ACNES患者疼痛来源于腹壁,行RSB后疼痛评分减少一半以上基本可以判断其疼痛来源于腹壁,再结合病史和体格检查,基本可以确诊ACNES^[60]。

2. 前皮神经卡压综合征的治疗 RSB可用于未



成年 ACNES 患者的治疗,据文献报道其治疗成功率可达 38%。对于未成年 ACNES 患者,可行间断多次 RSB 治疗^[61]。RSB 还可用于成年人 ACNES 的治疗,其治愈率大约为 33%^[62]。

3. 腹部手术后慢性腹壁疼痛的治疗 患者因腹部手术后周围神经损伤导致慢性腹壁疼痛,行 RSB 后疼痛明显减轻,恢复正常活动,睡眠得到改善^[63]。

利益冲突 所有作者均声明无利益冲突

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(收稿日期:2022-08-25)

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本文引用格式

王小平,王锴,舒海华,等. 腹直肌鞘阻滞中国专家共识(2023版)[J]. 中华疼痛学杂志, 2023, 19(1): 13-21. DOI: 10.3760/cma.j.cn101658-20220825-00204.

