椎体内椎基神经射频消融术治疗 Modic 改变性慢性腰痛的研究进展

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摘　要　无症状的 Modic 改变无需特殊处理，但对于经非手术治疗无效的 Modic 改变性慢性腰痛，则需要考虑手术治疗。椎体内椎基神经射频消融术是治疗 Modic 改变性慢性腰痛的一种微创手术方法。该方法通过射频热消融损毁支配退变椎体终板的椎基神经，阻断疼痛信号的传导，从而达到减轻腰背部疼痛和改善腰部功能的目的。为进一步认识椎体内椎基神经射频消融术在 Modic 改变性慢性腰痛治疗中的应用，本文概述了 Modic 改变，从手术方法、适应证、禁忌证、临床疗效等方面，对椎体内椎基神经射频消融术治疗 Modic 改变性慢性腰痛的研究进展进行了综述。

关键词　腰痛；射频消融；Modic 改变；综述

慢性腰痛（chronic low back pain，CLBP）是一种常见的肌肉骨骼系统疾病，可严重影响患者的工作和生活[1-2]。既往认为，椎间盘破裂是引起 CLBP 最常见的原因。但近年来越来越多的研究表明，椎体终板病变也是导致 CLBP 的重要原因[3-5]。椎基神经（basivertebral nerve，BVN）是窦椎神经的分支，伴随椎基血管从椎体后缘正中、椎弓根水平的椎基静脉孔进入椎体中心形成神经血管簇，并向上下椎体均匀发出分支，支配椎体终板[6-7]。椎体终板病变会导致 BVN 的增殖[5]。与正常椎体终板相比，病变椎体终板中 BVN 伤害感受器密度更高[8-9]。Modic 改变是椎体终板病变引起的椎间盘髓核与椎体骨髓之间的炎症级联反应在 MRI 上的表现[10-11]。无症状的 Modic 改变无需特殊处理，而对于非手术治疗无效的 Modic 改变引起的难治性、持续性 CLBP，则需要考虑手术治疗。椎体内 BVN 射频消融术是一种通过射频热消融损毁病变椎体内的 BVN，阻断疼痛信号的传输而缓解疼痛的微创手术方法[6]。近年来，椎体内 BVN 射频消融术用于治疗 Modic 改变性 CLBP，取得了显著的临床疗效[12-14]。为进一步了解该方法在 Modic 改变性 CLBP 治疗中的应用，我们概述了 Modic 改变，从手术方法、适应证、禁忌证、临床疗效等方面，对椎体内 BVN 射频消融术治疗 Modic 改变性 CLBP 的研究进展进行综述。

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1　Modic 改变概述

椎体终板内含有丰富的毛细血管，这些毛细血管将营养物质运输到无血管分布的椎间盘中[15]。当椎体终板发生病变时，不仅会对椎间盘的营养供给造成影响，还会对椎体应力分布造成影响，加速椎间盘退变[16]。而退变的椎间盘会促进肿瘤坏死因子-α、白细胞介素和神经生长因子等炎症物质释放，导致椎体终板神经增殖[17]。在机械和化学刺激下，疼痛信号传递到 BVN，再通过窦椎神经经脊神经腹侧支和灰交通支到达交感干，进而上传到背根神经节，最后在神经中枢形成痛觉，被感知为腰痛[18]。

Modic 改变又称椎体终板信号改变，是 MRI 上椎体终板及终板下骨质的异常影像学变化，常成对出现，且多发生于 L_4 ~ S_1 节段[15-16]。Modic 改变分为 3 型[19]，即Ⅰ型（水肿型）、Ⅱ型（脂肪型）、Ⅲ型（硬化型）。见表 1、图 1。Ⅰ型和Ⅱ型 Modic 改变与 CLBP 关系密切。与无 Modic 改变的患者相比，有Ⅰ型或Ⅱ型 Modic 改变的 CLBP 患者疼痛发作的频率更高、持续时间更长，且治疗效果更差[20-21]。

表 1　Modic 改变分型

分型	MRI 表现
Ⅰ型（水肿型）	T1WI 低信号，T2WI 高信号，脂肪抑制序列高信号
Ⅱ型（脂肪型）	T1WI 高信号，T2WI 高信号，脂肪抑制序列低信号
Ⅲ型（硬化型）	T1WI、T2WI 及脂肪抑制序列均为低信号

2　椎体内 BVN 射频消融术的手术方法

患者俯卧位，采用局部浸润麻醉或全身麻醉。

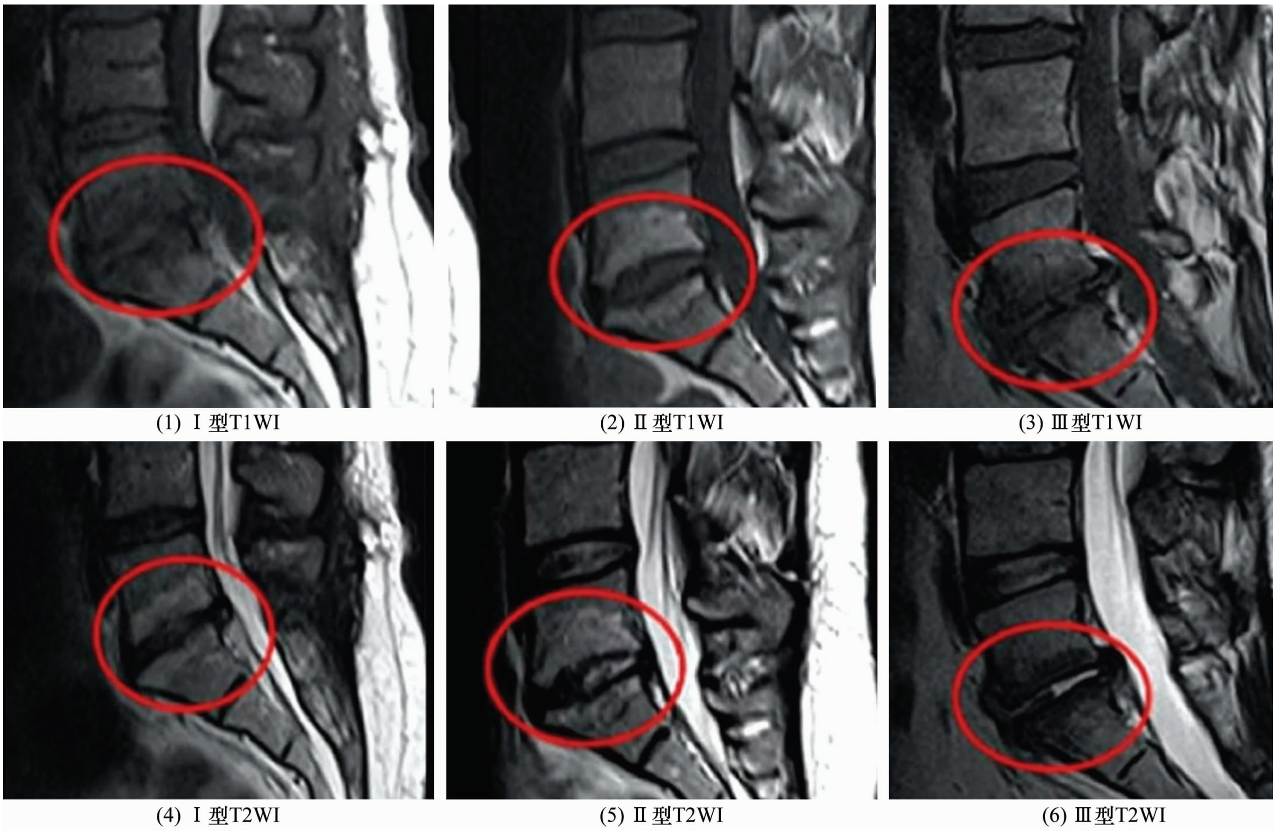

图 1　Modic 改变 MRI

X 线透视下,根据解剖学标志,确定并标记治疗部位及进针点。X 线透视下,用穿刺针穿过椎弓根,直至其针尖穿透椎体后壁。取出穿刺针,置入弯曲套管针至椎体中心。取出弯曲套管针,置入射频探头至椎体中心的椎基静脉孔末端。激活射频探头,85 ℃维持 15 min,使其在椎体中心形成直径约 1 cm 的球形消融灶。取出射频探头和套管,用无菌敷料覆盖包扎穿刺部位。

3　椎体内 BVN 射频消融术的手术适应证和禁忌证

椎体内 BVN 射频消融术治疗 Modic 改变性 CLBP 的手术适应证[22-23]:①经 6 个月非手术治疗无效;②MRI 上有Ⅰ型或Ⅱ型 Modic 改变。而当有以下任何一种情况时,禁行 BVN 射频消融术[24-25]:①年龄 <18 岁;②有下肢出现沿皮节分布的疼痛、麻木等神经根性症状;③影像上有椎管狭窄表现,且有间歇性跛行;④椎间盘突出物 >5 mm;⑤有全身或局部感染;⑥椎体中心距椎管 <10 mm;⑦体内有心脏起搏器、除颤器或其他电子植入物;⑧合并严重的心肺疾病;⑨妊娠期妇女。

4　椎体内 BVN 射频消融术治疗 Modic 改变性 CLBP 的临床疗效

2017 年,Becker 等[26]首先报道了采用椎体内 BVN 射频消融术治疗腰椎间盘造影阳性且有Ⅰ型或Ⅱ型 Modic 改变的 CLBP 患者 16 例,术后患者腰部疼痛缓解,功能明显改善,其中 81% 的患者 Oswestry 功能障碍指数(Oswestry disability index,ODI)至少降低了 10 分。Schnapp 等[27]报道了与 Becker 等的报道类似的结果,且发现术后 1 个月、3 个月、6 个月随访时,患者 ODI 分别下降了 13.1 分、16.5 分、21.1 分。但这 2 项报道的病例数较少,且未设立对照组,结果可能存在偏倚。Smuck 等[28]为观察椎体内 BVN 射频消融术治疗 Modic 改变性 CLBP 的临床疗效,进行了随机对照试验研究,发现术后 3 个月,BVN 消融组患者腰部疼痛视觉模拟量表(visual analogue scale,VAS)评分和 ODI 均低于对照组,且在术后 12 个月随访时,这种情况持续存在。Fischgrund 等[29]将 225 例 Modic 改变性 CLBP 患者分成 BVN 射频消融术组和假手术组,术后 3 个月 BVN 射频消融术组患者腰部疼痛 VAS 评分和 ODI 分别平均下降 20.5 分和 1.5 分,且在术后2年随访时,腰部疼痛VAS评分和ODI分别

改善52.9%和53.7%。为进一步验证椎体内BVN射频消融术对Modic改变性CLBP的远期疗效,该团队继续对BVN射频消融术组的117例患者进行5年随访,结果发现,47%的患者腰部疼痛减轻>75%,其中34%的患者腰部疼痛完全消失[30]。

阿片类药物是CLBP患者最常用的药物,61%的CLBP患者在症状出现1年内至少接受了1次阿片类药物治疗,其中59%的患者接受短效阿片类镇痛药,39%的患者接受长效阿片类镇痛药[31]。Truumees等[17]研究发现,采用BVN射频消融术治疗的Modic改变性CLBP患者,术后3个月随访时,50%的患者停止了阿片类药物的使用,另外50%的患者减少了阿片类药物的使用。Fischgrund等[29]的研究也发现,术后12个月随访时,BVN射频消融术组60.7%的患者减少了阿片类药物的用量,其中46.4%的患者完全停止了阿片类药物的使用。但Khalil等[18,28]研究发现,术后3个月随访时,BVN射频消融组与对照组之间在减少阿片类药物应用方面无明显差异。

5 小 结

Modic改变性CLBP的发病机制尚不清楚,目前尚无针对其病因的治疗方法。椎体内BVN射频消融术治疗Modic改变性CLBP,在缓解腰背部疼痛、改善腰部功能方面疗效显著,能减少患者阿片类药物的用量,且与椎间盘切除和腰椎椎体融合等传统手术相比,该方法具有创伤小、恢复快等优点[32]。但椎体内BVN射频消融术成功与否,取决于靶点位置是否精确,能否有效对BVN进行消融[33]。虽然目前椎体内BVN射频消融术大多以椎体中心处椎基静脉孔的末端为靶点,但由于椎基静脉孔详细解剖定位尚不明确,关于BVN射频消融靶点的定位尚存在争议。有学者[18,34]认为,椎体内BVN射频消融术靶点定位在椎体前后距离30%~50%处的手术成功率要高于定位在椎体前后距离40%~60%处。但目前尚缺乏确切的临床证据证明此观点。因此,对BVN和椎基静脉孔的解剖位置进行进一步研究,为靶点的精确定位提供解剖学支持,是提高椎体内BVN射频消融术手术成功率亟待解决的问题。

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