

# Progress in the Treatment of Lumbar Spinal Stenosis by Percutaneous Foraminoscopy

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## Abstract

Lumbar spinal stenosis (LSS) is a common degenerative disease with a range of clinical symptoms resulting from lumbar degeneration, osteosis, and thickening of fibrous ligament tissue resulting in stenosis of the spinal canal or nerve root canal, with direct or indirect stimulation and compression of nerve roots. Patients often present with intermittent neurogenic claudication. With the aging of China's population, its incidence is increasing year by year. When the disease reaches a certain level, surgical intervention is often needed to improve the patient's quality of life. According to its surgical methods, it can be divided into spinal decompression, lumbar fusion and interspinous process fixation device. Traditional posterior laminectomy decompression and interbody fusion is a common surgical method, but this surgical method has great damage to the posterior spinal muscles, which is easy to cause postoperative lumbar syndrome, lumbar instability, epidural scar and other related complications. With the development of technology, percutaneous endoscopy is gradually applied in the treatment of lumbar spinal stenosis. It is highly respected by patients and physicians because of its small injury and fast postoperative recovery. This paper reviews the current status of percutaneous foraminoscopy in the treatment of lumbar spinal stenosis.

## Keywords

lumbar spinal stenosis; percutaneous foraminoscopy; transforaminal approach; an interlaminar approach was made

## 经皮椎间孔镜技术治疗腰椎管狭窄症的治疗进展

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## 摘要

腰椎管狭窄症(Lumbar Spinal Stenosis, LSS)是一种常见的退行性疾病,通常是由于腰椎退变、骨质增生、纤维韧带组织增厚,导致椎管或神经根管狭窄,直接或间接刺激、压迫神经根而引起的一系列临床症状,患者经常表现为间歇性神经源性跛行。随着中国人口老龄化的程度逐渐加重,其发病率也呈逐年上涨的趋势。当病发展到一定程度时,通常需要外科手术干预,及时改善患者的生活质量。根据其手术方式可以分为椎管减压术、腰椎融合术及加装棘突固定装置。传统的后路切除椎板减压椎间融合手术是常见的手术方式,但此术式对脊柱后方肌肉损伤较大,容易导致术后腰椎综合征、腰椎不稳、硬膜外瘢痕等相关并发症。随着技术的发展,经皮内镜技术逐渐应用在腰椎管狭窄症的治疗。因其损伤小、术后恢复快而被患者和医师所推崇。论文主要对使用经皮椎间孔镜技术治疗腰椎管狭窄的现状进行综述。

## 关键词

腰椎管狭窄; 经皮椎间孔镜; 经椎间孔入路; 经椎板间入路

## 1 经皮内镜技术的发展历史及现状

早在20世纪,Valls和Craig等人采用脊柱侧后入应用套管对椎体进行活检,为经皮椎间孔镜技术的后外侧入路奠定了基础<sup>[1]</sup>。1991年Kambin等人提出了位于椎间孔内的“安全三角理念”,并报道使用关节镜于后外侧入路切除椎间盘

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的技术,其优良率为85%。<sup>[2,3]</sup>此技术虽然不能对椎管内结构进行充分的减压,但是为椎间孔镜技术划定了安全操作区,同时为后来1977年Yeung<sup>[4,5]</sup>等人提出的YESS技术的提出奠定了基础。YESS技术提倡减压应由内向外,即“in-out”首先处理椎间盘内部,然后再处理突入椎管内的部分。但此技术的减压范围依旧有限,处理位于椎管内部的病变十分困难,因此采用该技术难以在侧隐窝型椎管狭窄及中央型腰椎管狭窄的治疗取得满意的疗效。2002年,Hoogland在YESS技术的基础上提出由外到内的减压,即“out-in”,此技术扩大了经皮脊柱内镜的手术适应症范围<sup>[6]</sup>。从最早的单纯腰椎间盘突出的治疗,转向腰椎管狭窄症及轻度的腰椎滑脱等疾病的

治疗,并取得了令人满意的手术效果。但该技术学习曲线陡峭,且术中所需透视次数较多,且随着微创的概念越来越普及,经皮椎间孔镜技术、及手术器械的不断更新,许多专家根据自己的经验提出了众多的新技术路线使该技术越来越完善。2007年,Hoohland提出了MaXMore技术,使用高速磨钻处理退变增生的骨质,同时该磨钻为保护性钝头,能够在提高镜下减压效率的同时,减少神经根损伤,缩短手术时间。Laurysen发明了一种微型动力刀片系统,能够达到对腰椎侧隐窝部位达到充分减压还能够尽可能多的保留关节突,避免因去除过多的骨质而导致的脊柱不稳<sup>[7,8]</sup>。由于关节突根部血管丰富,因此Ahn提出,从关节突尖部进行截骨,能够扩大椎间孔,增加操作范围,减少神经及血管损伤的风险<sup>[9]</sup>。由于患者需求的增加和内窥镜设备的发展,经皮椎间孔镜技术的适应症正变得越来越普遍<sup>[10-13]</sup>。Zhang等提出可以通过调整穿刺角度,增加穿刺针头倾角的方法在磨除骨质时更多的保护了上关节突腹侧,避免损伤关节面,减少磨骨量,并指出该技术适合应用于椎间孔及侧隐窝的狭窄的治疗<sup>[14-16]</sup>。中国的专家“白一冰”也提出了对该技术的新的改进方法<sup>[17]</sup>,即BEIS技术,该技术在TESSYS的基础上得到发展,该技术的核心和主要目的是实现对硬膜及神经根的腹侧减压,通过调整套管角度,完成椎间孔扩大成型,获得更为清楚的解剖结构及手术视野,对椎管内进行充分减压,在腰椎管狭窄症的治疗方面取得了满意的成果,但仍存在对中央型腰椎管减压效果不佳的局限性。有报道称,在某些病例中,内窥镜椎间盘切除术的手术结果与传统的开腹椎间盘切除术相似<sup>[18,19]</sup>。目前外科手术越来越趋向于微创化,而经皮椎间孔镜技术因其对患者损伤小,并且能够获得良好的疗效,获得了广泛认可,并随着众多医师对该技术的完善而变得越来越成熟。

## 2 入路的选择

目前使用经皮椎间孔镜技术治疗腰椎管狭窄症主要采用两种入路,即经椎间孔入路和经椎板间入路<sup>[20,21]</sup>。但目前采用两种入路治疗腰椎管狭窄症的效果仍有争议,部分研究者认为,该技术减压范围有限,很难达到理想的效果。WEN等通过研究,认为采用经皮椎间孔镜技术可以处理轻度的单阶段腰椎管狭窄以及轻度的椎管内骨质增生和黄韧带肥厚,而对于重度的腰椎管狭窄或合并有腰椎不稳、脊柱侧弯的患者疗效较差<sup>[22]</sup>。但也有研究报道,使用经皮椎间孔镜技术治疗中央型腰椎管狭窄,取得了良好的近期疗效<sup>[23]</sup>。除了这两种入路外,Choi等人报道了经硬膜外入路治疗上腰椎因钙化型椎间盘突出间接导致中央型腰椎管狭窄的技术,虽然能够保留小关节突,但是切开硬膜容易导致脑脊液漏及神经损伤,他们认为该入路并不是一种常规入路,但可作为神经严重受

损时的一种相对安全的入路<sup>[24]</sup>。Ruetten和Choi等人报道了一种使用经皮内镜经椎板间入路进行减压的技术,该技术通常采用全身麻醉的方式,外科医生通过磨除病变间隙的部分椎板以及部分关节突后可以通过椎板间隙到达椎管,切除突出的位于中央和中央旁病变,该技术对高度移位的髓核或椎间盘源性狭窄患者有效。经椎板间入路的解剖结构与传统切开融合类似,相较于经椎间孔入路降低了定位难度,减少术者及患者术中的辐射暴露,并被认为在一定程度上能够缩短手术时间<sup>[25-28]</sup>。LI等人的研究指出采用两种入路均能取得令人满意的治疗效果,且效果无明显差异<sup>[29]</sup>。但有研究人员比较了两种入路的手术结果,发现采用椎板间入路容易发生术后下肢感觉障碍<sup>[30,31]</sup>。因此,采用椎板间入路应当注意测量术前患者责任阶段的椎板间隙大小,评估上下椎板之间的关系,避免过多磨除骨质导致医源性椎体不稳,或因环钻的使用导致神经根的损伤。Kimetal报告了使用经皮椎间孔镜技术治疗31例腰椎间盘突出症的结果,其中15例采用椎板间入路,16例采用经椎间孔入路。他们发现,在平均26.5个月的随访期内,6.5%的患者发生了感觉改变,3.2%的患者出现了一过性轻度运动无力,3.2%的患者出现了腰椎间盘突出复发<sup>[32]</sup>。综上所述,对于狭窄位置主要在椎间孔或侧隐窝的患者,比较适合采用经椎间孔入路。对于狭窄位置主要位于神经根背侧,由于黄韧带肥厚导致的中央型腰椎管狭窄则比较适合采用经椎板间入路。对于病变节段位于L5-S1的患者,若预计因髂脊较高,定位穿刺责任间隙困难,难以获得充分的操作空间从而达到充分减压,或采用经椎间孔入路的情况下,对于骨质磨除较多,可能会影响到脊柱的稳定性,则可以采用经椎板间入路。术中注意尽量减少对脊柱骨质的磨除,在进行神经根腹侧的减压时,减少对神经根的牵拉,避免出现手术导致的神经损伤。无论采用以上哪两种入路,术前都应该对患者的全身状态如年龄、心肺功能以及患者狭窄的位置、椎体退变的程度进行仔细的评估,明确手术指征,才能最终取得令人满意的疗效。

## 3 经皮椎间孔镜技术的不足

PELD技术面临的主要挑战是中央型椎管狭窄,这是由于其视野及操作区域的限制。无法进行对侧椎管及硬膜囊背侧的减压;而对于严重的椎间孔狭窄,经椎间孔入路操作困难。另外,经椎间孔L入路治疗L5/S1椎间盘突出,尤其是合并高髂嵴、L5横突肥大等情况,由于限制了工作通道的充分移动,致摘除突出的髓核组织非常困难。

## 4 经皮椎间孔镜技术的优势

与传统开放手术相比,椎间孔镜治疗LSS的优势:①可

以在局麻下进行,手术切口小,持续时间短,出血少,恢复快,这为有基础疾病或者年龄较大不能耐受开放手术的患者提供了可行的治疗方案。②无后韧带结构及肌肉损伤,可能减少医源性节段性不稳定或脊椎滑脱的发生。

常见并发症:椎间孔镜治疗LSS的常见并发症有术后神经根分布区域感觉异常,硬脊膜、神经根损伤等<sup>[22]</sup>,有些并发症可以通过熟练技术操作、扎实解剖基础、术前严格掌握手术适应证等措施有效地预防。

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