

### 【临床研究】

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**关键词:** 超声检查;初产妇;腹直肌分离度;肛提肌裂孔长度;肛提肌裂孔面积;盆腔器官脱垂

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**Abstract:** **Objective** To investigate the value of ultrasound examination of the diastasis recti abdominis (DRA), levator hiatus length (LHL) and levator hiatus area (LHA) in evaluating the pelvic organ prolapse (POP) of primipara. **Methods** A total of 110 primipara admitted to the First Affiliated Hospital of Henan University of Science and Technology from April 2021 to May 2022 to check the recovery of pelvic floor muscles at 6 – 12 weeks after delivery were selected as the study subjects. All primipara received ultrasound examination and the DRA, LHL and LHA were measured after admission. The DRA, LHL and LHA of primipara with different pelvic organ prolapse quantitation (POP-Q) stages were compared. The correlation between DRA, LHL, LHA and POP-Q stage was analyzed by Spearman correlation. The predictive value of DRA, LHL and LHA on the POP-Q stage of primipara was evaluated by the receiver operator characteristic (ROC) curve. **Results** There were significant differences in DRA at 3 cm above the umbilicus, umbilical part and 3 cm below the umbilicus of primipara in different POP-Q stages ( $P < 0.05$ ). The DRA at each position of primipara in stage III and IV was significantly higher than that of primipara in

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stage II ( $P<0.05$ ). The DRA at each position of primipara in stage IV was significantly higher than that of primipara in stage III ( $P<0.05$ ). There were significant differences in LHL and LHA of primipara in different POP-Q stages under resting state, Valsalva action and muscoli levator ani contraction ( $P<0.05$ ). The LHL and LHA at each position of primipara in stage III and IV were significantly higher than those of primipara in stage II ( $P<0.05$ ). The LHL and LHA at each position of primipara in stage IV were significantly higher than those of primipara in stage III ( $P<0.05$ ). The Spearman correlation analysis showed that the DRA, LHL and LHA of primipara were positively correlated with POP-Q stage ( $r=0.437, 0.512, 0.483; P<0.05$ ). The ROC curve analysis showed that there was no significant difference in the area under curve of the separate measurement of DRA, LHL and LHA in predicting POP of primipara ( $Z=0.958, P>0.05$ ). The area under curve of the combination of DRA, LHL and LHA in predicting the POP of primipara was significantly higher than that of the separate measurement of the three indexes ( $Z=5.325, 3.867, 4.312; P<0.05$ ). The sensitivity of the combination of DRA, LHL and LHA to predict the POP of primipara was significantly higher than that of the separate measurement ( $Z=5.764, 5.108, 3.423; P<0.05$ ). The specificity of the combination of DRA, LHL and LHA to predict the POP of primipara was significantly higher than that of the separate measurement ( $Z=4.231, 4.021, 3.020; P<0.05$ ). The accuracy of the combination of DRA, LHL and LHA in predicting the POP of primipara was significantly higher than that of the separate measurement of the three indexes ( $Z=4.325, 4.464, 3.337; P<0.05$ ). There was no significant difference in the sensitivity, specificity and accuracy of DRA, LHL and LHA alone in predicting POP of primipara ( $Z=1.021, 0.876, 1.144; P>0.05$ ). **Conclusion** DRA, LHL, LHA are significantly correlated with the severity of POP in primipara, which can be used as the effective indexes for early evaluation of pelvic floor function of puerpera. The dynamic monitoring of DRA, LHL and LHA by ultrasound examination in the early postpartum period can provide reference for the formulation of postpartum rehabilitation programs.

**Key words:** ultrasonography examination; primipara; diastasis recti abdominis; levator hiatus length; levator hiatus area; pelvic organ prolapse

盆腔器官脱垂(pelvic organ prolapse, POP)是指因盆底组织薄弱引起盆腔器官下移,导致器官位置及功能异常,主要表现为阴道口组织物脱出,部分患者伴有排尿、排便和性功能障碍等,给患者的生理、心理造成严重损伤<sup>[1]</sup>。研究显示,经阴道分娩的女性 POP 发病率显著高于未生产及剖宫产分娩的女性<sup>[2-3]</sup>。盆腔器官脱垂定量(pelvic organ prolapse quantitation, POP-Q)分期是目前临床评估产妇产后盆底肌康复情况的主要方法,该方法主要通过测量最大 Valsalva 动作时盆腔内器官脱出长度进行判断<sup>[4]</sup>。但有研究指出,POP-Q 测量准确度与患者的 Valsalva 动作指令完成程度及医生的专业度密切相关,存在一定的局限性<sup>[5]</sup>。有研究显示,女性盆底功能障碍往往与肛提肌群、腹部肌群等有直接关系,POP-Q 仅能提供与骨盆器官表面解剖结构相关的信息,无法考虑盆腔内器官的功能和解剖结构,对阴道旁缺陷情况诊断不足<sup>[6-7]</sup>。超声检查具有操作简单、分辨率高、无创安全等优点,已广泛应用于妇科相关疾病的检查,其不仅可通过多角度平面清晰地展现盆腔内结构和盆底形态变化,且能通过后台处理技术准确判断腹部肌群及肛提肌群的实际情况,为疾病的临床诊断提供数据支持<sup>[8-9]</sup>。目前,关于超声检查腹直肌分离度(diastasis recti abdominis, DRA)、肛提肌裂孔长度(levator hiatus length, LHL)、肛提肌裂孔面积(levator hiatus area, LHA)预测初产妇 POP 的相关研究较少,基于此,本研究对 110 例初产妇进行

超声检查,测量并计算 DRA、LHL、LHA,探讨其对初产妇 POP 的预测价值。

## 1 资料与方法

**1.1 一般资料** 选择 2021 年 4 月至 2022 年 5 月于河南科技大学第一附属医院分娩后 6~12 周入院检查盆底肌恢复情况的初产妇 110 例为研究对象,初产妇年龄 21~35 ( $26.76 \pm 2.59$ ) 岁,孕周 37~40 ( $38.46 \pm 1.15$ ) 周,体质指数 18~24 ( $22.34 \pm 1.68$ )  $\text{kg} \cdot \text{m}^{-2}$ ;单胎妊娠 76 例,多胎妊娠 34 例;POP-Q 分期<sup>[10]</sup>:Ⅱ期 33 例,Ⅲ期 47 例,Ⅳ期 30 例。研究对象纳入标准:(1)年龄 20~35 岁,无妊娠史;(2)自愿接受本研究检查方式,且家属支持;(3)无严重精神疾病,意识清晰,能正常沟通;(4)近 2 周内未服用雌激素类药物;(5)能有效完成 Valsalva 动作;(6)自然分娩。排除标准:(1)有 POP 史;(2)有盆腔相关手术史;(3)合并盆腔占位性病变;(4)伴有艾滋病、淋病等特殊疾病;(5)同时参与其他课题研究。本研究经医院伦理委员会审核批准,所有初产妇及家属签署知情同意书。

**1.2 方法** 所有产妇入组后接受 POP-Q 分期<sup>[10]</sup>和空腹超声检查(测量 DRA、LHL 及 LHA;所有超声检查均由同一位超声科医生操作,获得影像结果由 2 名 10 a 以上工作经验超声诊断医师独立诊断,并准确记录)。(1)盆底超声检查:使用 WS80A 超声诊断仪(三星麦迪逊上海医疗器械有限公司)及

D8-4U型凸阵探头(深圳市威尔德医疗电子有限公司),频率2~7 MHz;检查前8 h禁食,检查时适当充盈膀胱(尿量<50 mL),协助产妇取截石位,使用一次性避孕套包括探头,于尿道口及阴道口进行正中矢状面扫描,获得正中矢状面二维图像,声像图上以耻骨联合下缘水平线作参考线,分别在静息时、Vasalva动作时、肛提肌收缩时截取盆底矢状面、横切面及冠状面影像,测量LHL(矢状面肛管直肠连接部后缘与耻骨联合后下缘间的距离)及LHA。(2)腹直肌超声检查:使用SiemensSequoia512型号多普勒超声检查仪(上海西门子医疗器械有限公司)搭配ML6-15-D高频探头(美国通用电气公司)对产妇腹部进行扫描,扫描范围:脐中心上方3 cm至脐下方3 cm处,检测时产妇取仰卧位,保持放松状态,双下肢伸直,探头垂直于腹壁及人体中轴线,当超声图像清晰显示腹直肌内侧边缘时冻结图像并存储,分别在脐中心及上下3 cm处测量DRA(两侧腹直肌在腹白线上的内侧止点对应的2个点之间的横向线性距离),每个状态下测量3次,取均值。

**1.3 统计学处理** 应用SPSS 26.0软件进行统计学分析。计量资料以均数±标准差( $\bar{x} \pm s$ )表示,多个样本均数比较采用方差分析,两两比较采用*t*检验;采用Spearman相关分析DRA、LHL及LHA与POP-Q分期的相关性;采用受试者操作特征(receiver operating characteristic,ROC)曲线评价DRA、LHL及LHA对POP的预测价值;*P*<0.05为差异有统计学意义。

表 2 不同 POP-Q 分期初产妇不同状态下 LHL 及 LHA 比较

POP-Q 分期		LHL/cm			LHA/cm <sup>2</sup>		
		静息状态	Vasalva 动作时	肛提肌收缩时	静息状态	Vasalva 动作时	肛提肌收缩时
Ⅱ期	33	5.59±0.54	6.41±0.51	4.75±0.38	17.75±1.91	26.58±3.75	13.24±2.35
Ⅲ期	47	5.94±0.61 <sup>a</sup>	6.98±0.59 <sup>a</sup>	4.96±0.47 <sup>a</sup>	22.34±2.11 <sup>a</sup>	31.42±3.12 <sup>a</sup>	15.33±2.28 <sup>a</sup>
Ⅳ期	30	6.22±0.46 <sup>ab</sup>	7.34±0.48 <sup>ab</sup>	5.18±0.45 <sup>ab</sup>	24.12±1.51 <sup>ab</sup>	33.68±3.69 <sup>ab</sup>	16.81±2.19 <sup>ab</sup>
<i>F</i>		10.351	24.193	7.528	97.001	35.157	8.458
<i>P</i>		<0.001	<0.001	<0.05	<0.001	<0.001	<0.001

注:与Ⅱ期初产妇比较<sup>a</sup>*P*<0.05;与Ⅲ期初产妇比较<sup>b</sup>*P*<0.05。

**2.3 POP-Q 分期与 DRA、LHL 及 LHA 的相关性** Spearman 相关分析显示,初产妇的DRA、LHL及LHA与POP-Q分期均呈正相关(*r*=0.437、0.512、0.483,*P*<0.05)。

**2.4 DRA、LHL 及 LHA 对初产妇 POP 的预测价值** 结果见图1和表3。ROC曲线分析显示,单独测量DRA、LHL和LHA预测初产妇发生POP的曲线下面积(area under curve,AUC)比较差异无统计学意义(*Z*=0.958,*P*>0.05);DRA、LHL、LHA联合预测初产妇发生POP的AUC显著高于三者单独测量(*Z*=5.325、3.867、4.312,*P*<0.05)。DRA、LHL、

2 结果

**2.1 不同 POP-Q 分期初产妇不同位置的 DRA 比较** 结果见表1。不同POP-Q分期初产妇的脐上3 cm、脐部及脐下3 cm处的DRA比较差异均有统计学意义(*P*<0.05);Ⅲ、Ⅳ期初产妇各个位置的DRA显著大于Ⅱ期初产妇,差异有统计学意义(*P*<0.05);Ⅳ期初产妇各个位置的DRA显著大于Ⅲ期初产妇,差异有统计学意义(*P*<0.05)。

表 1 不同 POP-Q 分期初产妇不同位置的 DRA 比较  
Tab. 1 Comparison of DRA in different positions of primipara in different POP-Q stages ( $\bar{x} \pm s$ )

POP-Q 分期	<i>n</i>	DRA/cm		
		脐上 3 cm	脐部	脐下 3 cm
Ⅱ期	33	1.71±0.39	2.43±0.50	1.05±0.31
Ⅲ期	47	1.98±0.58 <sup>a</sup>	2.73±0.71 <sup>a</sup>	1.37±0.29 <sup>a</sup>
Ⅳ期	30	2.31±0.41 <sup>ab</sup>	3.02±0.48 <sup>ab</sup>	1.51±0.24 <sup>ab</sup>
<i>F</i>		12.016	7.742	22.355
<i>P</i>		<0.001	0.001	<0.001

注:与Ⅱ期初产妇比较<sup>a</sup>*P*<0.05;与Ⅲ期初产妇比较<sup>b</sup>*P*<0.05。

**2.2 不同 POP-Q 分期初产妇不同状态下 LHL 及 LHA 比较** 结果见表2。不同POP-Q分期初产妇静息状态、Vasalva动作、肛提肌收缩时的LHL、LHA比较差异均有统计学意义(*P*<0.05);Ⅲ、Ⅳ期初产妇各个状态下的LHL、LHA显著大于Ⅱ期初产妇,差异有统计学意义(*P*<0.05);Ⅳ期初产妇各个状态下的LHL、LHA显著大于Ⅲ期初产妇,差异有统计学意义(*P*<0.05)。

LHA联合预测初产妇发生POP的敏感度显著高于三者单独测量,差异有统计学意义(*Z*=5.764、5.108、3.423,*P*<0.05);DRA、LHL、LHA联合预测初产妇发生POP的特异度显著高于三者单独测量,差异有统计学意义(*Z*=4.231、4.021、3.020,*P*<0.05);DRA、LHL、LHA联合预测初产妇发生POP的准确度显著高于三者单独测量,差异有统计学意义(*Z*=4.325、4.464、3.337,*P*<0.05)。单独测量DRA、LHL、LHA预测初产妇发生POP的敏感度、特异度、准确度比较差异无统计学意义(*Z*=1.021、0.876、1.144,*P*>0.05)。

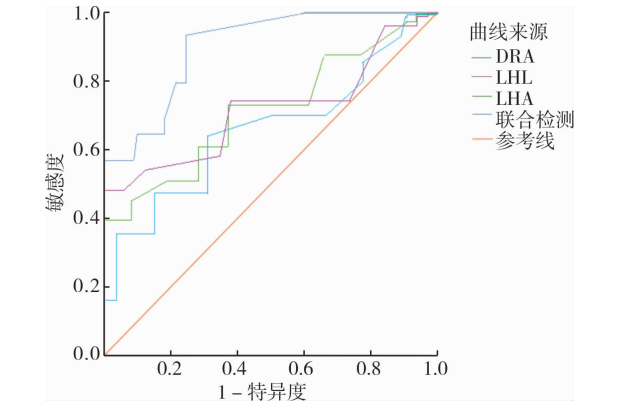


图1 DRA、LHL 和 LHA 预测初产妇发生 POP 的 ROC 曲线  
Fig.1 ROC curve of DRA, LHL and LHA predicting POP in primipara

表3 DRA、LHL 及 LHA 对初产妇 POP 的预测价值  
Tab.3 Predictive value of DRA, LHL and LHA on POP of primipara

变量	敏感度/%	特异度/%	准确度/%	约登指数	95% 置信区间		AUC
					下限	上限	
DRA	78.79	67.65	75.00	0.464	0.554	0.657	0.596
LHL	81.58	73.53	79.09	0.551	0.610	0.735	0.662
LHA	80.52	69.70	77.27	0.502	0.597	0.683	0.615
三者联合检测	90.22 <sup>a</sup>	83.33 <sup>a</sup>	89.09 <sup>a</sup>	0.736	0.711	0.824	0.796 <sup>a</sup>

注:与 DRA、LHL 和 LHA 比较<sup>a</sup> $P<0.05$ 。

3 讨论

POP 若不能得到及时有效的治疗,在疾病进展过程中,可能并发多个盆腔组织或器官的脱垂及盆底功能障碍相关疾病,增加治疗难度<sup>[11]</sup>。因此,尽早明确 POP 情况并给予有效的治疗对初产妇产后盆底功能恢复有重要意义。超声检查是一种基于超声波的医学影像学诊断技术,可使肌肉和内脏器官的大小、结构和病理学病变可视化,通过多方面成像动态测量患者盆腔组织的相关裂孔,对患者盆腔器官受损程度、移动度等进行量化分析,为临床针对性制定治疗方案提供参考<sup>[12-13]</sup>。但需要注意的是,由于女性盆腔底部主要借助肛提肌与筋膜组织的相互作用锚定在盆骨壁上,盆腔内器官复杂,器官及组织相对封闭和隐匿,腹壁超声无法全面观察器官脱垂情况,采用盆底超声和腹直肌超声联合检查可及时明确腹直肌分离情况及肛提肌裂孔的面积和长度变化。

本研究对 110 例分娩后初产妇进行超声检查,测量 DRA 及 LHL 和 LHA,结果显示,不同 POP-Q 分期初产妇不同位置的 DRA、不同状态下 LHL 和 LHA 比较差异均有统计学意义;Ⅲ、Ⅳ期初产妇各个位置的 DRA、各个状态下的 LHL 和 LHA 均显著大于Ⅱ期初产妇,Ⅳ期初产妇各个位置的 DRA、各个状态下的 LHL 和 LHA 均显著大于Ⅲ期初产妇。

进一步 Spearman 相关分析显示,DRA、LHL 和 LHA 与 POP-Q 分期均呈正相关,提示 DRA、LHL、LHA 与初产妇 POP 严重程度有显著相关性。FEI 等<sup>[14]</sup> 研究表示,产后第 1 年女性腹直肌分离发生率高达约 82.6%。BLOMQUIST 等<sup>[15]</sup> 研究显示,自然分娩产妇的 LHL、LHA 及 POP 发生率均显著高于剖宫产产妇。究其原因可能为:(1)妊娠过程中,随着胎儿及妊娠附属物的生长发育,腹压逐渐升高,对盆底肌肉及筋膜组织的压迫力逐渐增大,长此以往导致盆底肌群张力减弱,最终无法支撑盆腔器官;(2)根据骨盆动力学理论,腹部肌肉与盆底肌肉间存在协同作用,腹肌变薄弱会影响腹、盆腔肌群的动力学,同理,盆底肌削弱可在一定程度上增加腹直肌的牵拉力,增加 DRA<sup>[16]</sup>;(3)自然分娩的产妇在用力娩出胎儿的过程中,胎儿经阴道娩出时会对盆底组织产生高度挤压,导致肛提肌受损,肌群张力、收缩力降低,无法发挥对盆腔器官的托举作用,导致 POP 的发生<sup>[17]</sup>。此外,通过 ROC 曲线分析显示,DRA、LHL、LHA 联合检测预测初产妇发生 POP 的敏感度、特异度和 AUC 显著高于三者单独检测,提示三者联合检测可较为准确地反映初产妇 POP 情况,具有较高的敏感度和特异度。

综上所述,DRA、LHL、LHA 与初产妇 POP 的严重程度有显著相关性,可作为早期评估产妇盆底功能的有效指标,初产妇早期可通过超声联合检测 DRA、LHL、LHA 评估 POP 情况,可准确反映产妇盆底功能,以便于针对性调整干预策略,促进产后康复。

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