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盆底超声参数与经阴道分娩初产妇产后盆底功能的关系及对早期发生盆腔脏器脱垂的预测研究 *

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摘要 目的：探讨盆底超声参数与经阴道分娩初产妇产后盆底功能的关系及对早期发生盆腔脏器脱垂的预测价值。**方法：**选择2021年9月至2022年9月来我院行规律产检的阴道分娩产妇80例作为研究对象。本研究对80例产妇在产后6~8周进行盆底超声检查，记录检查时的Valsalva、缩肛动作下的肛提肌裂孔面积、前后径、膀胱尿道后角信息。对比两组静息、缩肛状态下及Valsalva动作的肛提肌裂孔面积、前后径、膀胱尿道后角水平，分析两组盆底肌功能指标，分析病例组盆底肌功能指标与静息、缩肛、Valsalva动作时盆底超声参数指标的相关性，盆底超声参数预测早期发生盆腔脏器脱垂的ROC曲线分析。**结果：**病例组的静息、缩肛状态下及Valsalva动作的肛提肌裂孔面积、前后径、膀胱尿道后角水平较对照组高（P<0.05）。病例组的盆底Ⅰ类肌肌力、盆底Ⅱ类肌肌力、阴道指诊盆底肌力明显较对照组低（P<0.05）。盆底Ⅰ类肌肌力、盆底Ⅱ类肌肌力、阴道指诊盆底肌力与静息、缩肛、Valsalva动作时的肛提肌裂孔面积、前后径、膀胱尿道后角水平均呈负相关（P均<0.05）。静息、缩肛、Valsalva动作时的盆底超声参数指标对盆腔脏器脱垂的AUC均超过0.5，P均<0.05。**结论：**盆底超声参数与经阴道分娩初产妇产后盆底功能呈负相关，可用于早期发生盆腔脏器脱垂的预测，值得临床上推广应用。

关键词：盆底超声参数；经阴道分娩初产妇；产后盆底功能；盆腔脏器脱垂；预测分析

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Relationship between Pelvic Floor Ultrasound Parameters and Puerperal Pelvic Floor Function in Parturient Parturients with Vaginal Delivery and Prediction of Early Pelvic Organ Prolapse*

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ABSTRACT Objective: To investigate the pelvic ultrasound parameters and the vaginal delivery mothers postpartum pelvic floor functional relations and value for early prediction of pelvic organ prolapse. **Methods:** 80 vaginal parturients who came to our hospital from September 2021 to September 2022 for regular birth examination were selected as subjects. In this study, 80 parturient women underwent pelvic floor ultrasound examination at 6-8 weeks postpartum, and recorded the information of Valsalva, hiatus area of levator ANI muscle under anal contraction, anteroposterior diameter and posterior Angle of bladder and urethra during the examination.The hiatus area of levator anal muscle, anterior-posterior diameter and posterior Angle of bladder and urethra of the two groups were compared under resting and anal contraction and Valsalva movements, and the pelvic floor muscle function indexes of the two groups were analyzed, and the correlation between the pelvic floor muscle function indexes and ultrasonic parameters of the pelvic floor under resting, anal contraction and Valsalva movements in the case group was analyzed. ROC curve analysis of pelvic floor ultrasonic parameters predicting early pelvic organ prolapse. **Results:** The levels of hiatus area, anterior-posterior diameter and posterior Angle of vesicurethra of levator anal muscle at rest, anal retraction and Valsalva movement in case group were higher than those in control group (P<0.05). The class Ⅰ muscle strength, class Ⅱ muscle strength and vaginal finger diagnosis pelvic floor strength of case group were lower than those of control group (P<0.05). Pelvic floor class I muscle strength, pelvic floor class II muscle strength, and vaginal finger pelvic floor muscle strength were negatively correlated with the area of anal fissure, anterior-posterior diameter, and level of posterior vesicourethral angle during resting, retraction, and Valsalva maneuvers (all P<0.05). The AUC of pelvic floor ultrasound parameters indexed during resting, retraction, and Valsalva maneuvers for pelvic organ prolapse exceeded 0.5 (all P<0.05). **Conclusion:** Pelvic floor ultrasound parameters are negatively correlated with the puerperal pelvic floor function of primipara during vaginal delivery, which can be used to predict the

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early occurrence of pelvic organ prolapse and is worthy of clinical application.

Key words: Pelvic floor ultrasonic parameters; Primiparia vaginalis; Postpartum pelvic floor function; Pelvic organ prolapse; Predictive analysis

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前言

盆腔脏器脱垂是女性盆底功能障碍性疾病的一个主要表现，其是由多种原因引起的盆底支持组织损伤或薄弱，引起盆腔器官移位，使得盆腔功能或位置异常，包括阴道后壁膨胀出、阴道前壁膨胀出、子宫脱垂三种类型[1,2]。有研究发现[3]，在我国盆腔脏器脱垂的发病率约为 3.4 %~56.7 %。其发病机制较为复杂，病因多样，盆底结缔组织松弛、盆底肌肉损伤是引起盆腔脏器脱垂的主要原因，而妊娠、分娩是盆腔脏器脱垂的危险因素，给产妇产后的心理情绪、生活质量产生极大影响[4,5]。阴道分娩会直接引起损伤盆腔支持结构，从而诱发盆腔器官脱垂，临床上需采用有效的诊断方法及早明确疾病，从而给予积极治疗[6,7]。临床上多采用盆底电生理检查反应盆腔脏器位置及功能变化。近年来，随着超声影像技术的发展，盆底超声已逐渐用于盆底功能、结构的评估[8,9]。与磁共振、CT 成像检查相比，盆底超声具有经济、无创、可重复性好、简便等优点[10,11]。而盆底超声的参数是否用于早期发生盆腔脏器脱垂的预测仍不明确，因此本文分析了盆底超声参数与经阴道分娩初产妇产后盆底功能的关系及其对早期发生盆腔脏器脱垂的预测研究，以为早期发生盆腔脏器脱垂选择有效的诊断方法提供依据。

1 资料与方法

1.1 病例资料

选择 2021 年 9 月至 2022 年 9 月来我院行规律产检的阴道分娩产妇 80 例作为研究对象。根据是否发生盆腔脏器脱垂，将 80 例患者分为病例组(16 例)与对照组(64 例)。

80 例患者中，病例组年龄分布在 21~38 岁，平均 28.78± 3.12 岁，孕周 38~41 周，平均 39.43± 0.89 周，体质指数：19.4~25.9 kg/m^2，平均 22.89± 1.87 kg/m^2；对照组年龄分布在 20~39 岁，平均 29.10± 3.45 岁，孕周分布在 37~40 周，平均 38.99± 1.02 周，体质指数：19.2~25.8 kg/m^2，平均 23.10± 1.56 kg/m^2，两组一般资料对比无差异(P>0.05)。

纳入标准：病例组符合盆腔脏器脱垂的诊断标准[12]，两组年龄分布在 20~39 岁，均为单胎足月阴道分娩，围产期无严重并发症，产后 6~8 周回院检查，孕周 37~41 周，体质指数 19.2~25.9 kg/m^2，本研究所有患者知情同意且符合医学伦理。

排除标准：合并严重盆腔疾病者、双胎或多胎妊娠者、剖宫产者、既往有盆腔器官脱垂史、盆腔手术史者、生殖及泌尿系统合并感染或急性炎症者、产后产生强烈抵抗情绪者、存在盆腔占位病变或盆腔肿瘤者等。本研究经我院医院伦理委员会批准同意。

1.2 检查方法

本研究的 80 例产妇在产后 6~8 周，均使用彩色多普勒超声诊断仪(迈瑞，R6)行盆底超声检查，产妇取常规的截石位，之后在探头上涂抹耦合剂，行阴道超声检查。将在阴道外口与阴部尿道间贴着耻骨联合下缘进行探查，之后调整耻骨联合中轴线，保持与耻骨联合下缘水平线在 45° ，将小肛提肌裂孔的平面作为参考，观察肌肛提肌裂孔、损伤、形态与生殖系统解剖结构，获取肛提肌裂孔的形态等信息。之后要求产妇行 Valsalva 与缩肛动作，在屏气状态下用力向下增加腹压，获取超声图像冻结储存并处理，记录 Valsalva、缩肛动作下的肛提肌裂孔面积、前后径、膀胱尿道后角信息。

1.3 观察指标

(1)对比两组静息状态下的肛提肌裂孔面积、前后径、膀胱尿道后角水平；

(2)对比两组缩肛状态下的肛提肌裂孔面积、前后径、膀胱尿道后角水平；

(3)对比两组 Valsalva 动作时的肛提肌裂孔面积、前后径、膀胱尿道后角水平；

(4)分析两组盆底肌功能指标，使用 RX-PD-01 压力盆底肌力测试仪(福州仁馨医疗科技有限公司生产)测量盆底的Ⅰ类肌、Ⅱ类肌的肌力，使用改良的牛津力对盆底肌力进行评估判断，从 0 级 ~5 级(不能感觉到盆底肌收缩至强有力收缩)，其中≥3 级为盆底肌力正常[13]；

(5)分析病例组盆底肌功能指标与静息、缩肛、Valsalva 动作下盆底超声参数指标的相关性；

(6) 盆底超声参数预测早期发生盆腔脏器脱垂的 ROC 曲线分析。

1.4 统计学方法

SPSS23.0 软件，计数资料频数表示，卡方检验分析，计量资料 $\bar{x}\pm s$ 表示，t 检验分析，P<0.05 为差异有统计学意义。

2 结果

2.1 对比两组静息状态下的肛提肌裂孔面积、前后径、膀胱尿道后角水平

病例组的静息状态下的肛提肌裂孔面积、前后径、膀胱尿道后角水平较对照组高(P<0.05)。

2.2 对比两组缩肛状态下的肛提肌裂孔面积、前后径、膀胱尿道后角水平

观察组缩肛状态下的肛提肌裂孔面积、前后径、膀胱尿道后角水平明显较对照组高(P<0.05)。

2.3 对比两组 Valsalva 动作时的肛提肌裂孔面积、前后径、膀胱尿道后角水平

病例组的肛提肌裂孔面积、前后径、膀胱尿道后角水平较对照组高(P<0.05)。

2.4 分析两组盆底肌功能指标

病例组的盆底Ⅰ类肌肌力、盆底Ⅱ类肌肌力、阴道指诊盆底肌力明显较对照组低(P<0.05)。

表 1 对比两组静息状态下的肛提肌裂孔面积、前后径、膀胱尿道后角水平($\bar{x}\pm s$)

Table 1 The hiatus area of levator ANI muscle, anterior and posterior diameters, and the posterior Angle of vesicurethra were compared between the two groups at rest($\bar{x}\pm s$)

Groups	n	Hiatus of levator ANI area (cm^2)	Anterior and posterior diameter of hiatus of levator ANI(cm)	The posterior Angle of the bladder and urethra is horizontal(°)
Case group	16	24.1± 3.5	5.1± 0.7	121.6± 14.3
Control group	64	18.4± 2.9	4.5± 0.5	110.3± 9.8
t	-	10.617	5.023	4.649
P	-	<0.001	<0.001	<0.001

表 2 对比两组缩肛状态下的肛提肌裂孔面积、前后径、膀胱尿道后角水平($\bar{x}\pm s$)

Table 2 The hiatus area, anterior and posterior diameters of levator ANI and posterior angles of bladder and urethra were compared between the two groups($\bar{x}\pm s$)

Groups	n	Hiatus of levator ANI area (cm^2)	Anterior and posterior diameter of hiatus of levator ANI(cm)	The posterior Angle of the bladder and urethra is horizontal(°)
Case group	16	19.8± 3.7	4.9± 0.6	118.9± 12.3
Control group	64	14.3± 2.9	4.3± 0.4	110.5± 10.4
t	-	8.627	5.897	4.383
P	-	<0.001	<0.001	<0.001

表 3 对比两组 Valsalva 动作时的肛提肌裂孔面积、前后径、膀胱尿道后角水平($\bar{x}\pm s$)

Table 3 To compare the area of the anal raphe fissure, anterior and posterior diameters, and the level of the posterior angle of the vesicourethra during the Valsalva maneuver in the two groups ($\bar{x}\pm s$)

Groups	n	Hiatus of levator ANI area (cm^2)	Anterior and posterior diameter of hiatus of levator ANI (cm)	The posterior Angle of the bladder and urethra is horizontal (°)
Case group	16	27.5± 4.8	5.8± 0.7	147.8± 15.8
Control group	64	19.4± 3.8	4.7± 0.6	120.6± 13.8
t	-	9.782	9.978	10.771
P	-	<0.001	<0.001	<0.001

表 4 分析两组盆底肌功能指标($\bar{x}\pm s$)

Table 4 The analysis of functional indexes of pelvic floor muscle in the two groups ($\bar{x}\pm s$)

Groups	n	Pelvic floor class I muscle strength(mmHg)	Pelvic floor class II muscle strength(mmHg)	Pelvic floor strength in vaginal finger diagnosis (grade)
Case group	16	11.4± 2.6	19.5± 4.1	2.1± 0.4
Control group	64	25.8± 5.2	30.5± 6.3	3.8± 0.5
t	-	-25.202	-13.535	-19.674
P	-	<0.001	<0.001	<0.001

2.5 分析病例组盆底肌功能指标与静息、缩肛、Valsalva 动作下盆底超声参数指标的相关性

盆底Ⅰ类肌肌力、盆底Ⅱ类肌肌力、阴道指诊盆底肌力与静息、缩肛、Valsalva 动作时的肛提肌裂孔面积、前后径、膀胱尿道后角水平均呈负相关(*P* 均 <0.05)。

2.6 盆底超声参数预测早期发生盆腔脏器脱垂的 ROC 曲线

静息、缩肛、Valsalva 动作时的盆底超声参数指标对盆腔脏器脱垂的 AUC 均超过 0.5,*P* 均 <0.05,ROC 曲线见图 1。

表 5 分析病例组盆底肌功能指标与静息、缩肛、Valsalva 动作下盆底超声参数指标的相关性

Table 5 The correlation between the functional indexes of pelvic floor muscle and the ultrasonic parameters of pelvic floor under resting, anal contraction and Valsalva movements was analyzed

Indexs		Rest			Anus retraction			Valsalva		
		Hiatus of levator ANI area	Anterior and posterior diameter of hiatus of levator ANI	The posterior Angle of the bladder and urethra is horizontal	Hiatus of levator ANI area	Anterior and posterior diameter of hiatus of levator ANI	The posterior Angle of the bladder and urethra is horizontal	Hiatus of levator ANI area	Anterior and posterior diameter of hiatus of levator ANI	The posterior Angle of the bladder and urethra is horizontal
Pelvic floor class I muscle strength	r	-5.167	-4.678	-6.234	-6.254	-4.897	-6.789	-5.667	-4.768	-6.564
	P	0.018	0.025	0.005	0.003	0.020	0.000	0.015	0.024	0.003
Pelvic floor class II muscle strength	r	-6.778	-5.464	-6.785	-6.987	-5.123	-6.913	-5.786	-5.034	-6.980
	P	0.000	0.014	0.000	0.000	0.019	0.000	0.013	0.017	0.000
Pelvic floor strength in vaginal finger diagnosis	r	-4.987	-4.513	-5.674	-5.999	-4.344	-6.342	-5.122	-4.098	-6.433
	P	0.019	0.030	0.004	0.006	0.035	0.000	0.009	0.028	0.000

表 6 盆底超声参数预测早期发生盆腔脏器脱垂的 ROC 曲线分析

Table 6 The ROC curve analysis of pelvic floor ultrasound parameters in predicting the early occurrence of pelvic organ prolapse

State	Index	AUC	*P*	95%CI
Rest	Hiatus of levator ANI area	0.572	0.031	0.510~0.714
	Anterior and posterior diameter of hiatus of levator ANI	0.536	0.040	0.505~0.698
	The posterior Angle of the bladder and urethra is horizontal	0.575	0.030	0.513~0.721
Anus retraction	Hiatus of levator ANI area	0.568	0.035	0.508~0.706
	Anterior and posterior diameter of hiatus of levator ANI	0.520	0.043	0.502~0.675
	The posterior Angle of the bladder and urethra is horizontal	0.594	0.025	0.520~0.734
Valsalva	Hiatus of levator ANI area	0.686	0.014	0.610~0.813
	Anterior and posterior diameter of hiatus of levator ANI	0.558	0.037	0.510~0.713
	The posterior Angle of the bladder and urethra is horizontal	0.698	0.010	0.614~0.823

3 讨论

产妇在妊娠、分娩过程中易产生盆底肌松弛[14]；此外在分娩阶段，产妇的盆底肌因牵拉，会导致韧带、肛提肌的功能出现损伤，最终诱发盆腔脏器脱垂[15-17]。临床上多采用盆腔脏器脱垂量化系统对盆腔脏器脱垂进行评估，但其相对复杂且有一定主观性。采用三维超声可对女性盆底解剖的结构、功能进行观察及评估[18,19]，因此三维超声是盆腔脏器脱垂量化诊断的首选技术。因此本文将三维超声用于经阴道分娩初产妇产后盆底功能的检查，并探讨其对早期发生盆腔脏器脱垂的预测价值。

本文结果表明，病例组的静息、缩肛状态下及 Valsalva 动作的肛提肌裂孔面积、前后径、膀胱尿道后角水平明显较对照组高。表明盆腔脏器脱垂产妇与正常产妇的产后超声参数存在差异，也说明三维超声可用于盆腔脏器脱垂患者盆底功能的诊断，主要是由于与二维超声相比，三维超声行盆底可充分显示横断位、矢状位、冠状位的断面，通过多角度、多平面的成像，获取实时动态图像，从而对肛提肌结构与盆腔脏器结构进行准确的评估[20,21]。本研究结果类似于姚勇英等[22]的研究结果，姚勇英等选择 96 例产后盆腔脏器脱垂患者为观察组，选择同期分娩的 96 例健康产妇为对照组，所有产妇在行盆底三维超声检查，发现两组的三维超声检查参数、肛提肌裂孔面积、肛提肌裂孔前后径、膀胱尿道后角存在差异，与本文研究类似，而姚勇英等

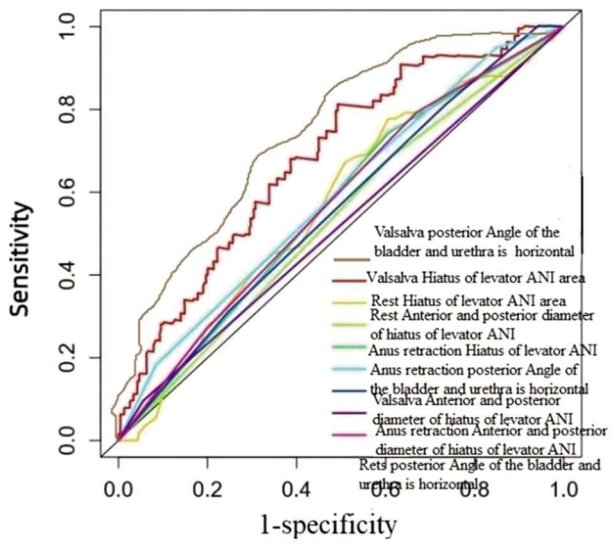

图 1 盆底超声参数预测早期发生盆腔脏器脱垂的 ROC 曲线

Fig.1 ROC curve of pelvic floor ultrasound parameters predicting early pelvic organ prolapse

研究分析了盆腔脏器脱垂产妇不同治疗效果的盆底三维超声检查参数，而本研究所选盆腔脏器脱垂产妇样本量不足，治疗后部分患者未行三维超声检查，收集资料不齐，因此未对此进行分析，有待后续扩大样本量进行深入分析。

本文结果表明，病例组的盆底Ⅰ类肌肌力、盆底Ⅱ类肌肌力、阴道指诊盆底肌力明显较对照组低，表明与正常产妇相比，盆腔脏器脱垂患者的盆底功能受到损伤，主要是由于在妊娠时，会导致产妇的盆底功能损伤。正常情况下盆底会受到日常活动的腹压增加及腹腔器官向下重力影响，在腹腔腹压吸引作用，多数脏器会在膈肌下吸附悬吊，各脏器均衡指向腹腔侧方周围，对盆底功能影响较小[23,24]。而在妊娠期，孕妇子宫会不断增大，孕晚期子宫会成为垂直器官，使得妊娠期盆腹腔脏器的重心合力方向出现变化，因此妊娠期孕妇盆底组织会长期处于受压状态，盆底肌收缩时间、力度有代偿性增加，随着孕妇孕周增加，盆底肌肉收缩会继续转为失代偿，继发出现缺氧、缺血等，继而孕妇出现圆韧带、耻骨宫颈筋膜、骶韧带等组织出现应力方向的拉伸、变形、撕裂，从而表现为盆腔脏器脱垂[25,26]。此外在妊娠期，雌激素、孕激素、血清松弛素水平升高，其中盆底功能与血清松弛素水平关系密切，产时产妇的血清松弛素水平与非孕期时明显升高，而高水平松弛素会通过增加细胞外间质金属蛋白酶、胶原蛋白酶活性，来起到胶原分泌、合成、沉积的抑制作用，促进胶原降解，对盆底支持组织产生影响；且胶原含量会导致盆底损伤先期改变，降低盆底结缔组织强度，使得产妇在分娩时盆底功能更易受损[27,28]。同时阴道分娩时会引起神经源性损伤与肌源性损伤两种盆底肌肉损伤，在第二产程中，盆底神经被拉伸达 0.33 倍，肛提肌被拉伸达到 3.3 倍，肌源性损伤会对肛提肌产生巨大剪切力、牵拉力，不断降低收缩力与收缩强度，进而降低盆底支撑力，盆腔脏器下移，最终出现盆腔脏器脱垂；同时胎先露下降、胎儿娩出、胎头着冠会对盆底周围软组织持续性机械性压迫及高度扩张，降低盆底支撑，出现盆腔脏器脱垂；此外产后当产妇打喷嚏、咳嗽等腹压增加时，压力不能有效传导至尿道，也会出现盆腔脏器脱垂，而阴道分娩时，产妇更易出现盆底肌肉损伤，出现盆底功能障碍[29,30]。本研究两组产妇的盆底功能存在差异，可能与产妇的血清松弛素水平有关。

本文结果表明，盆底Ⅰ类肌肌力、盆底Ⅱ类肌肌力、阴道指诊盆底肌力与静息、缩肛、Valsalva 动作时的肛提肌裂孔面积、前后径、膀胱尿道后角水平均呈负相关。静息、缩肛、Valsalva 动作时的盆底超声参数指标对盆腔脏器脱垂的 AUC 均超过 0.5，表明盆底超声参数可用于早期盆腔脏器脱垂的预测。

综上所述，盆底超声参数与经阴道分娩初产妇产后盆底功能呈负相关，可用于早期发生盆腔脏器脱垂的预测。

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