

doi: 10.13241/j.cnki.pmb.2021.10.024

经会阴三维超声评价不同分娩方式初产妇肛门括约肌复合体和盆膈裂孔的临床应用价值*

张秀丽¹ 曹韵清^{1△} 袁雅婷¹ 温影红¹ 肖汀¹ 马穗红²

(1 中山大学附属佛山医院超声诊疗中心 广东 佛山 528000;

2 华南理工大学附属第二医院/广州市第一人民医院超声医学科 广东 广州 510180)

摘要 目的:探讨经会阴三维超声在不同分娩方式初产妇肛门括约肌复合体(ASC)和盆膈裂孔(PH)影响的评估价值。**方法:**选择2017年1月~2019年12月我院进行分娩的初产妇150例,按照分娩方式分成阴道分娩组71例,剖宫产组79例,比较两组基线资料。对所有受试者均实施经会阴三维超声检查,比较两组缩肛动作下肛门内括约肌(IAS)远端、中端及远端平面厚度,肛门外括约肌(EAS)远端平面及耻骨直肠肌(PRM)中端平面厚度,分娩前、产后6周、产后3个月PH左右径、PH前后径以及PH面积。**结果:**两组孕妇年龄、孕周及体质指数比较无差异($P>0.05$),阴道分娩组IAS近端6点钟方向、12点钟方向平面厚度以及IAS中端、12点钟方向平面厚度均小于剖宫产组($P<0.05$)。阴道分娩组EAS远端12点钟方向平面厚度小于剖宫产组($P<0.05$)。阴道分娩组产后6周的PH左右径大于剖宫产组($P<0.05$)。阴道分娩组产后6周的PH前后径大于剖宫产组($P<0.05$)。阴道分娩组产后6周的PH面积大于剖宫产组($P<0.05$)。**结论:**经会阴三维超声可有效评估初产妇ASC和PH的影响情况,分娩会对初产妇ASC和PH产生影响,阴道分娩的初产妇产后存在明显的ASC厚度减小和PH增大现象。

关键词:初产妇;分娩方式;经会阴三维超声;肛门括约肌复合体;盆膈裂孔

中图分类号:R714.3 **文献标识码:**A **文章编号:**1673-6273(2021)10-1916-05

The Clinical Value of Three-dimensional Transperineal Ultrasound in the Evaluation of Anal Sphincter Complex and Pelvic Diaphragmatic Hole in Primipara with Different Delivery Modes*

ZHANG Xiu-li, CAO Yun-qing^A, YUAN Ya-ting, WEN Ying-hong, XIAO Ting, MA Sui-hong

(1 Ultrasound Diagnosis and Treatment Center, Foshan Hospital Affiliated to Zhongshan University, Foshan, Guangdong, 528000, China;

2 Department of Ultrasound Medicine, The Second Affiliated Hospital of South China University of Technology/Guangzhou First People's Hospital, Guangzhou, Guangdong, 510180, China)

ABSTRACT Objective: To investigate the evaluate value of of three-dimensional transperineal ultrasound on the influence of anal sphincter complex (ASC) and pelvic diaphragmatic hole (PH) in primary parturient women. **Methods:** Selected 150 primary parturient women in our hospital from January 2017 to December 2019, which were divided into vaginal delivery group with 71 cases and cesarean section group with 79 cases, the baseline data of the two groups were compared. Three-dimensional ultrasonography was performed on anal constriction. The thickness of the distal, middle and distal plane of the internal anal sphincter (IAS), the distal plane of the external anal sphincter (EAS) and the middle plane of the puborectal muscle (PRM), the PH left and right diameter, PH diameter and PH area before delivery, 6 weeks after delivery, 3 months after delivery were compared between the two groups. **Results:** There was no difference in age, gestational age and body mass index between the two groups ($P>0.05$), the plane thickness of proximal 6 o'clock, 12 o'clock and 12 o'clock of the middle of IAS in vaginal delivery group were lower than that in cesarean section group ($P<0.05$). The 12 o'clock plane thickness of the distal end of EAS in vaginal delivery group was lower than that in cesarean section group ($P<0.05$). The PH left and right diameter of vaginal delivery group at 6 weeks after delivery was larger than that of cesarean section group ($P<0.05$). The PH diameter of vaginal delivery group at 6 weeks after delivery was higher than that of cesarean section group ($P<0.05$). The PH area of vaginal delivery group at 6 weeks after delivery was higher than that of cesarean section group ($P<0.05$). **Conclusion:** Three-dimensional ultrasound can effectively evaluate the impact of ASC and PH in primipara. Delivery will have an impact on ASC and pH in primary parturient women. There is a significant decrease in ASC thickness and increase in PH in primipara after vaginal delivery.

Key words: Primary parturient women; Delivery mode; Three-dimensional transperineal ultrasound; Anal sphincter complex; Pelvic diaphragmatic hiatus

Chinese Library Classification(CLC): R714.3 **Document code:** A

Article ID: 1673-6273(2021)10-1916-05

* 基金项目:广东省医学科研基金立项项目(2017A0274)

作者简介:张秀丽(1978-),女,本科,副主任医师,研究方向:孕产妇超声,E-mail: Zxli202020@163.com

△ 通讯作者:曹韵清(1982-),女,本科,主任医师,研究方向:孕产妇超声,E-mail: cyq641679886@163.com

(收稿日期:2020-11-04 接受日期:2020-11-27)

前言

妊娠及经阴道分娩等会对女性盆底功能和结构造成一定影响,甚至引起神经、肌肉以及结缔组织等受损,影响女性生活质量。研究表明,妊娠及经阴道分娩能引起女性盆膈裂孔(pelvic hiatus, PH)的增大,增加了盆底功能障碍性疾病(Pelvic floor dysfunction, PFD)的发病风险^[1]。目前报道显示,PFD在已婚女性中的发病率为20%~40%,包括盆腔脏器脱垂、排便障碍以及产后性功能降低等^[2,3]。肛门括约肌复合体(Anal sphincter complex, ASC)是由肛门内括约肌(internal anal sphincter, IAS)、耻骨直肠肌(puborectalis muscle, PRM)以及肛门外括约肌(external anal sphincter, EAS)等组成的复杂结构^[4]。妊娠及经阴道分娩会导致ASC损伤,可能引起短期或长期肛门失禁^[5]。然而,关于剖宫产是否会对女性盆底发挥保护作用尚且存在一定的争议,不同分娩方式是否会对女性盆底形态、结构以及功能产生不同影响尚未完全明确^[6,7]。经会阴三维超声技术是近年来发展的检查女性盆底疾病的手段之一,对女性PFD疾病的诊断具有很好的应用价值。本研究通过经会阴三维超声检查对不同分娩方式的初产妇的ASC和PH进行测量,旨在明确不同分娩方式在初产妇ASC和PH的影响,现作以下报道。

1 对象与方法

1.1 一般资料

将从2017年1月~2019年12月,于我院进行分娩的初产妇150例纳入研究。纳入标准:(1)所有纳入对象均为单胎足月妊娠;(2)妊娠晚期经超声检查证实胎儿大小符合孕周;(3)均接受经会阴三维超声检查;(4)均为初产妇。排除标准:(1)既往有盆腔手术史者;(2)意识障碍或伴有精神疾病者;(3)已进入第二产程出现分娩困难而进行剖宫产者;(4)正参与其他研究。将所有产妇按照分娩方式的不同分成阴道分娩组71例,剖宫产组79例。所有受试者均在知情同意书上签字,本研究获批于医院伦理委员会。

1.2 研究方法

经会阴三维超声检查:使用仪器为GE Voluson E8 Expert超声诊断仪,腔内容积探头,频率分为5~9 MHz。检查前告知受试者排空大小便,检查时均取截石位,髋部屈曲,双膝保持轻微外展状态。将探头放置在受试者的会阴部位,取横断面,受试者做缩肛动作,扫描范围从肛门末端直至肛直肠角,进行ASC的多平面观察。(1)近端平面:与肛直肠角远端相近的IAS平面;(2)中端平面:PRM于后方包绕IAS,显示最为清晰平面;(3)远端平面:对IAS以及EAS进行同时清晰显示的平面。分别测量IAS在3,6,9,12点钟时上述3个平面的厚度,如图1~3所示。测量EAS在3,6,9,12点钟时远端平面的厚度。测量PRM在4,8点钟方向中端平面的厚度。随后,将探头放置在阴唇处,取正中矢状切面获取三维图像,采集所有受检者的PH左右径、PH前后径以及PH面积。

1.3 观察指标

比较两组基线资料,比较两组IAS远端、中端及远端平面厚度,EAS远端平面及PRM中端平面厚度,分娩前和产后PH左右径、PH前后径以及PH面积。

1.4 统计学处理

数据应用SPSS 22.0软件分析,以率表示计数资料,行 χ^2 检验;以 $(\bar{x} \pm s)$ 表示计量资料,所有初产妇IAS近端、中端及远端平面厚度、EAS远端平面及PRM中端平面厚度、PH左右径、前后径、面积符合正态分布,行t检验,将 $P < 0.05$ 记作差异有统计学意义。

2 结果

2.1 两组基线资料比较

阴道分娩组年龄23~37岁,平均年龄 (27.41 ± 3.34) 岁,孕周38~41周,平均 (39.22 ± 1.07) 周;体质指数 $22.3 \sim 27.1 \text{ kg/m}^2$,平均 $(24.93 \pm 1.02) \text{ kg/m}^2$ 。剖宫产组年龄22~39岁,平均年龄 (28.20 ± 4.35) 岁;孕周38~42周,平均 (40.73 ± 1.01) 周;体质指数 $21.9 \sim 26.8 \text{ kg/m}^2$,平均 $(24.77 \pm 0.94) \text{ kg/m}^2$ 。两组上述指标比较无统计学差异($P > 0.05$)。

2.2 两组IAS远端、中端及远端平面厚度对比

阴道分娩组IAS近端6点钟方向、12点钟方向平面厚度以及IAS中端12点钟方向平面厚度均小于剖宫产组($P < 0.05$),两组IAS近端平面3点钟方向、9点钟方向,IAS中端平面3点钟方向、6点钟方向、9点钟方向,IAS远端平面3点钟方向、6点钟方向、9点钟方向、12点钟方向平面厚度比较无统计学差异($P > 0.05$),见表1和图1。

2.3 两组EAS远端平面及PRM中端平面厚度对比

阴道分娩组EAS远端平面12点钟方向平面厚度小于剖宫产组($P < 0.05$),两组EAS远端平面3点钟方向、6点钟方向、9点钟方向,PRM中端平面4点钟方向、8点钟方向平面厚度比较无统计学差异($P > 0.05$),见表2。

2.4 两组分娩前与产后6周、产后3个月PH左右径对比

阴道分娩组产后6周PH左右径大于分娩前,产后3个月PH左右径显著小于分娩前、产后6周($P < 0.05$),剖宫产组产后6周、产后3个月PH左右径小于分娩前($P < 0.05$),阴道分娩组产后6周的PH左右径大于剖宫产组($P < 0.05$),见表3。

2.5 两组分娩前与产后6周、产后3个月PH前后径对比

阴道分娩组产后6周PH前后径显著大于分娩前($P < 0.05$),产后3个月PH前后径与分娩前比较无统计学差异($P > 0.05$),但小于产后6周($P < 0.05$),剖宫产组产后6周、产后3个月PH前后径与分娩前比较无统计学差异($P > 0.05$)。阴道分娩组产后6周的PH前后径大于剖宫产组($P < 0.05$),见表4。

2.6 两组分娩前与产后6周、产后3个月PH面积对比

阴道分娩组产后6周PH面积显著大于分娩前($P < 0.05$),产后3个月PH面积与分娩前比较无统计学差异($P > 0.05$),但小于产后6周($P < 0.05$),剖宫产组产后6周、产后3个月PH面积与分娩前比较无统计学差异($P > 0.05$)。阴道分娩组产后6周的PH面积大于剖宫产组($P < 0.05$),见表5。

3 讨论

女性盆底组织结构复杂,由多层肌肉和筋膜构成,PH和ASC属于盆底相对薄弱环节^[8,9]。妊娠会引起腹压增加,压力向下直接作用在盆底结构,而分娩会引起盆底结构发生损伤,进一步导致盆底结构以及功能发生变化^[10-12]。当盆底肌肉以及结

表 1 两组 IAS 近端、中端及远端平面厚度对比($\bar{x} \pm s, \text{mm}$)

Table 1 Comparison of proximal, middle and distal plane thickness of IAS between the two groups($\bar{x} \pm s, \text{mm}$)

Items	Vaginal delivery group(n=71)	Cesarean section group(n=79)	t	P	
IAS proximal plane	3 o 'clock direction	2.04± 0.53	2.19± 0.65	1.538	0.126
	6 o 'clock direction	1.87± 0.52	2.12± 0.80	2.241	0.027
	9 o 'clock direction	2.16± 0.55	2.18± 0.57	0.218	0.828
	12 o'clock direction	1.52± 0.59	1.80± 0.56	2.981	0.003
IAS middle plane	3 o'clock direction	2.31± 0.55	2.40± 0.53	1.020	0.309
	6 o'clock direction	1.81± 0.56	1.75± 0.42	-0.747	0.456
	9 o'clock direction	2.37± 0.52	2.49± 0.58	1.328	0.186
	12 o'clock direction	1.67± 0.61	2.03± 0.59	3.672	0.000
IAS distal plane	3 o'clock direction	2.12± 0.57	2.17± 0.58	0.531	0.596
	6 o'clock direction	2.02± 0.59	1.99± 0.57	0.317	0.752
	9 o'clock direction	2.25± 0.55	2.34± 0.56	0.991	0.323
	12 o'clock direction	1.58± 0.54	1.64± 0.61	0.635	0.527

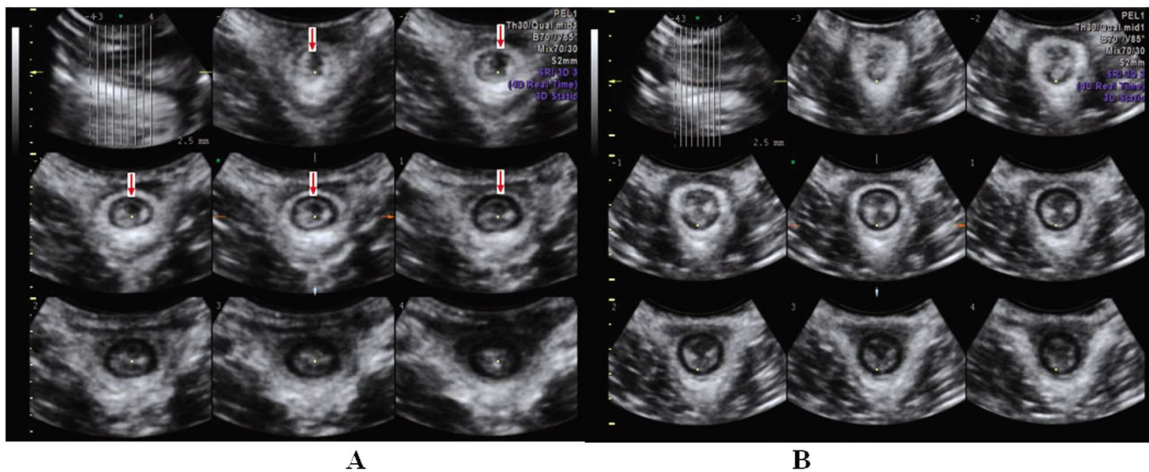


图 1 不同分娩方式初产妇的经会阴三维超声下的影像图

Fig.1 Perineal three-dimensional ultrasound images of primiparas with different delivery modes

Note: A: 30 years old primipara underwent cesarean section. The anal sphincter was observed in Tui mode under anal contraction. "↓" shown IAS proximal plane, and the middle plane of IAS was reduced at 12 o'clock. B: 36 years old primipara delivered via vagina. Anal sphincter was observed by Tui mode under anal contraction.

表 2 两组 EAS 远端平面及 PRM 中端平面厚度对比($\bar{x} \pm s, \text{mm}$)

Table 2 Comparison of the thickness of EAS distal plane and PRM the middle plane between the two groups($\bar{x} \pm s, \text{mm}$)

Items	Vaginal delivery group(n=71)	Cesarean section group(n=79)	t	P	
EAS distal plane	3 o'clock direction	2.91± 0.81	2.88± 0.79	0.229	0.819
	6 o'clock direction	2.14± 0.61	2.33± 0.80	1.622	0.107
	9 o'clock direction	3.15± 0.80	3.20± 0.79	0.385	0.701
	12 o'clock direction	1.03± 0.25	1.82± 0.56	10.944	0.000
PRMmiddle plane	4 o'clock direction	7.02± 1.39	7.23± 1.41	0.917	0.361
	8 o'clock direction	7.20± 1.41	7.31± 1.68	0.432	0.667

缔组织张力难以承受腹内压对盆底产生的压力时,盆底器官即会往下移位,围成盆底裂孔肌肉朝外膨出,进一步引起 pH 增

大,最终引发 PFD^[13-15]。经会阴三维超声检查可较为清晰、直观地显示受检者盆底结构以及相对空间位置,继而为产后盆底疾

表 3 两组分娩前分娩前与产后 6 周、产后 3 个月 PH 左右径对比($\bar{x} \pm s, \text{cm}$)Table 3 Comparison of PH diameter before delivery, 6 weeks after delivery and 3 months after delivery between the two groups($\bar{x} \pm s, \text{cm}$)

Groups	n	Before deliver	6 weeks after delivery	3 months after delivery
Vaginal delivery group	71	3.97 $\pm$ 0.32	4.19 $\pm$ 0.42*	3.84 $\pm$ 0.35**
Cesarean section group	79	4.00 $\pm$ 0.31	3.86 $\pm$ 0.31*	3.81 $\pm$ 0.34*
t	-	0.583	5.511	0.565
P	-	0.561	0.000	0.573

Note: compared with before delivery, * $P < 0.05$; Compared with 6 weeks after delivery, ** $P < 0.05$.

表 4 两组分娩前与产后 6 周、产后 3 个月 PH 前后径对比($\bar{x} \pm s, \text{cm}$)Table 4 Comparison of PH anteroposterior diameter between two groups before delivery, 6 weeks after delivery and 3 months after delivery($\bar{x} \pm s, \text{cm}$)

Groups	n	Before delivery	6 weeks after delivery	3 months after delivery
Vaginal delivery group	71	4.85 $\pm$ 0.45	5.42 $\pm$ 0.51*	4.83 $\pm$ 0.50#
Cesarean section group	79	4.88 $\pm$ 0.45	4.83 $\pm$ 0.46	4.79 $\pm$ 0.52
t	-	0.408	7.450	0.479
P	-	0.684	0.000	0.633

Note: compared with before delivery, * $P < 0.05$; Compared with 6 weeks after delivery, # $P < 0.05$.

表 5 两组分娩前与产后 6 周、产后 3 个月 PH 面积对比($\bar{x} \pm s, \text{cm}^2$)Table 5 Comparison of PH area before delivery, 6 weeks after delivery and 3 months after delivery($\bar{x} \pm s, \text{cm}^2$)

Groups	n	Before delivery	6 weeks after delivery	3 months after delivery
Vaginal delivery group	71	13.79 $\pm$ 1.79	15.04 $\pm$ 1.83*	13.80 $\pm$ 1.79*
Cesarean section group	79	13.80 $\pm$ 1.81	13.70 $\pm$ 1.28	13.61 $\pm$ 1.80
t	-	0.034	5.238	0.647
P	-	0.973	0.000	0.519

Note: compared with before delivery, * $P < 0.05$; Compared with 6 weeks after delivery, * $P < 0.05$.

病发生的预测提供参考依据^[16-18]。且相较于传统 MRI 检查而言,经会阴三维超声存在经济、操作简便以及可重复性较好等优势经会阴三维超声检查可获取较为满意的 ASC 三维图像,并通过后处理所存储的三维图像,实现多点测量,继而有利于清晰反映女性的 ASC 解剖形态变化。目前对于经阴道分娩对初产妇 PH 和 ASC 的影响较为明确,但对于剖宫产是否会对女性盆底产生影响仍未完全明确。

本研究通过对不同分娩方式初产妇经会阴三维超声检测结果比较发现,阴道分娩组 IAS 近端 6 点钟方向、12 点钟方向平面厚度以及 IAS 中端 12 点钟方向平面厚度均低于剖宫产组。与此同时,阴道分娩组 EAS 远端 12 点钟方向平面厚度低于剖宫产组。张原溪等对阴道分娩及剖宫产产妇 IAS、EAS 进行了比较,本研究在缩肛动作下得出结果与张原溪等报道基本相符^[19],这可能与本研究选取的孕妇年龄及孕周和该研究相接近有关,提示了不同分娩方式均会对初产妇的 IAS 以及 EAS 产生影响,但相对经阴道分娩,剖宫产对 IAS 以及 EAS 产生影响较轻,分析原因,经阴道分娩中,胎儿通过阴道对盆底产生压力,引起 IAS 以及 EAS 部分位置以及左右两侧 PRM 肌肉厚度变薄,对 ASC 功能造成不利影响,而剖宫产胎儿没有经过阴道因此对盆底影响较小^[20-22]。此外,阴道分娩组产后 6 周的 PH 前后径、左右径以及面积均高于剖宫产组,这在 Shui W 等人的研究报道中得以证实^[23],表明阴道分娩对于盆底结构造成的损伤

明显大于剖宫产。分析可能是经阴道分娩过程中肛提肌发生撕裂以及会阴神经出现损伤;分娩中胎头长时间压迫组织,可能引起盆底组织缺血、缺氧,损伤盆底组织^[24-26],女性分娩后机体会会有一个逐步恢复的过程,而阴道分娩对于盆底结构影响较大,产后使盆底组织代偿性生长,继而引起肛提肌发生撕裂以及会阴神经出现损伤^[27-29]。徐春等^[30]分析了经会阴三维超声评价不同分娩方式产妇 PH 产后 7 d 以及 2 个月的变化情况,结果显示经剖宫产分娩的产妇 PH 前后径、左右径以及面积均大于剖宫产组。本研究则对不同分娩方式产妇产前、产后的 PH 均进行了更为全面的检查、评估,更具有准确性,从结果来看,虽然阴道分娩产后 6 周 PH 前后径、左右径以及面积增大,但产后 3 个月可以恢复,经阴道分娩产妇盆底修复能力较强。但无论无论何种分娩方式均会对盆底组织结构以及功能造成损伤,产妇在产后均应予以盆底肌康复训练亦或是生物治疗,促进其盆底肌功能的恢复,预防盆底功能障碍的发生。然而,本研究尚且存在一定的不足之处,如样本量有限以及未对 ASC 厚度及肛门失禁关系进行分析,有待日后的进一步研究。

综上所述,经会阴三维超声可有效评估分娩方式对初产妇 ASC 和 PH 的影响情况,且以阴道分娩影响更为明显。因此,在临床实际工作中应重点预防经阴道分娩产妇的 PFD 发生,可通过盆底肌训练以及生物反馈训练等干预措施,实现降低 PFD 发生几率的目的。

参考文献(References)

- [1] Ali-Masri H, Hassan S, Ismail K, et al. Enhancing recognition of obstetric anal sphincter injuries in six maternity units in Palestine: an interventional quality improvement study [J]. *BMJ Open*, 2018, 8(6): 20983-20984
- [2] Klein T, Winkler A, Vahdad RM, et al. The Cologne pouch procedure for continent anal urinary diversion in children with bladder exstrophy-epispadias complex[J]. *J Pediatr Urol*, 2018, 14(5): 431-432
- [3] 郑小叶, 张丹, 谢晴, 等. 经会阴四维盆底超声动态成像对初产妇膀胱膨出疾病分级与分型的临床价值 [J]. *西部医学*, 2019, 31(12): 1935-1938
- [4] 陈姣, 彭晓梅, 熊浩然, 等. 不同分娩方式对产后盆底超声指标及盆底肌力的影响[J]. *中国妇幼保健*, 2019, 34(1): 21-24
- [5] 陈静, 龚国芸, 黄晴, 等. 经会阴三维超声评估不同分娩方式对初产女性盆膈裂孔影响的临床价值 [J]. *重庆医科大学学报*, 2016, 41(7): 703-707
- [6] 符元春, 张军辉, 杨红琳, 等. 经会阴实时三维超声评估不同分娩方式对产后女性盆膈裂孔面积的影响 [J]. *中国妇幼卫生杂志*, 2018, 9(5): 65-67, 76
- [7] 许源城, 杨飞, 李文标, 等. 经会阴实时三维超声在女性压力性尿失禁患者中的应用[J]. *广东医学*, 2017, 38(18): 2778-2781
- [8] 李肇英, 倪茂杰, 金静, 等. 经会阴超声在阴道分娩初产妇后早期盆底功能评估中的应用 [J]. *临床超声医学杂志*, 2016, 18(8): 565-566
- [9] Dapper H, Rodríguez I, Münch S, et al. Impact of VMAT-IMRT compared to 3D conformal radiotherapy on anal sphincter dose distribution in neoadjuvant chemoradiation of rectal cancer[J]. *Radiat Oncol*, 2018, 13(1): 237-238
- [10] Omar W, Alqasaby A, Abdelnaby M, et al. Drainage Seton Versus External Anal Sphincter-Sparing Seton After Rerouting of the Fistula Tract in the Treatment of Complex Anal Fistula: A Randomized Controlled Trial[J]. *Dis Colon Rectum*, 2019, 62(8): 980-987
- [11] Zifan A, Mittal RK, Kunkel DC, et al. Loop analysis of the anal sphincter complex in fecal incontinent patients using functional luminal imaging probe[J]. *Am J Physiol Gastrointest Liver Physiol*, 2020, 318(1): G66-G76
- [12] 余珊珊, 郑转梅, 乞艳华, 等. 经会阴二维及三维超声对压力性尿失禁患者TVT-O手术前后盆底结构的观察 [J]. *陕西医学杂志*, 2017, 46(2): 193-195
- [13] Ros C, Martínez-Franco E, Wozniak MM, et al. Postpartum two- and three-dimensional ultrasound evaluation of anal sphincter complex in women with obstetric anal sphincter injury[J]. *Ultrasound Obstet Gynecol*, 2017, 49(4): 508-514
- [14] Wu Y, Dabhoiwala NF, Hagoort J, et al. 3D Topography of the Young Adult Anal Sphincter Complex Reconstructed from Undeformed Serial Anatomical Sections [J]. *PLoS One*, 2015, 10(8): 0132226
- [15] Kim SJ, Kim MJ, Kim TH. Three-dimensional transperineal ultrasound: is there a correlation among age, weight, delivery mode, and a change in the pelvic floor architecture in Korean premenopausal women?[J]. *Clin Exp Obstet Gynecol*, 2016, 43(6): 857-861
- [16] García-Mejido JA, Gutiérrez Palomino L, Fernández Palacín A, et al. Fernández Palacín A, Applicability of 3/4D transperineal ultrasound for the diagnosis of anal sphincter injury during the immediate postpartum[J]. *Cir Cir*, 2017, 85(1): 80-86
- [17] Youssef A, Margarito E, Cappelli A, et al. Two- and three-dimensional transperineal ultrasound as complementary tool in management of vaginal hematoma [J]. *Ultrasound Obstet Gynecol*, 2019, 53(2): 272-273
- [18] Grob ATM, Hitschrich N, van de Waarsenburg MK, et al. Changes in global strain of puborectalis muscle during pregnancy and postpartum [J]. *Ultrasound Obstet Gynecol*, 2018, 51(4): 537-542
- [19] 张原溪, 史铁梅, 刘晨, 等. 经会阴三维超声评价顺产与剖宫产对初产妇肛门括约肌复合体的影响 [J]. *中国介入影像与治疗学*, 2018, 15(11): 683-688
- [20] García-Mejido JA, Gutiérrez L, Fernández-Palacín A, et al. Levator ani muscle injuries associated with vaginal vacuum assisted delivery determined by 3/4D transperineal ultrasound [J]. *J Matern Fetal Neonatal Med*, 2017, 30(16): 1891-1896
- [21] García Mejido JA, Suárez Serrano CM, Fernández Palacín A, et al. Evaluation of levator ani muscle throughout the different stages of labor by transperineal 3D ultrasound [J]. *Neurourol Urodyn*, 2017, 36(7): 1776-1781
- [22] Ozyurt S, Aksoy H, Gedikbasi A, et al. Screening occult anal sphincter injuries in primigravid women after vaginal delivery with transperineal use of vaginal probe: a prospective, randomized controlled trial [J]. *Arch Gynecol Obstet*, 2015, 292(4): 853-859
- [23] Shui W, Luo Y, Ying T, et al. Assessment of female pelvic floor support to the urethra using 3D transperineal ultrasound [J]. *Int Urogynecol J*, 2020, 31(1): 149-154
- [24] Montaguti E, Cariello L, Dodaro MG, et al. The role of a new three-dimensional ultrasound technique in the diagnosis of levator ani muscle avulsion[J]. *Neurourol Urodyn*, 2020, 39(1): 455-463
- [25] Ali-Masri H, Hassan S, Fosse E, et al. Impact of electronic and blended learning programs for manual perineal support on incidence of obstetric anal sphincter injuries: a prospective interventional study[J]. *BMC Med Educ*, 2018, 18(1): 258
- [26] Jansen C, de Mooij YM, Blomgaard CM, et al. Vaginal delivery in women with a low-lying placenta: a systematic review and meta-analysis[J]. *BJOG*, 2019, 126(9): 1118-1126
- [27] 丁凌, 胡兵, 陈亮, 等. 经腹、经阴道与经会阴三种超声途径测量宫颈长度对早产的预测价值 [J]. *现代生物医学进展*, 2016, 16(30): 5961-5963, 5973
- [28] Larsson C, Hedberg CL, Lundgren E, et al. Anal incontinence after caesarean and vaginal delivery in Sweden: a national population-based study[J]. *Lancet*, 2019, 393(10177): 1233-1239
- [29] Petersen RW. Vaginal delivery: An argument against requiring consent[J]. *Aust N Z J Obstet Gynaecol*, 2018, 58(6): 704-706
- [30] 徐春, 单炜丽. 经会阴三维超声评价经阴道分娩或剖宫产后女性盆膈裂孔变化的临床研究 [J]. *临床超声医学杂志*, 2017, 19(3): 178-181