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超声影像学对胎盘植入程度的危险度评价及与胎盘植入程度的相关性*

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摘要 目的: 探讨超声影像学对胎盘植入程度的危险度进行评价及与胎盘植入程度的相关性。**方法:** 回顾性分析 2017 年 7 月-2020 年 7 月期间于我院住院治疗的胎盘植入患者 60 例。分析分娩前超声影像学特点,按照胎盘位置及厚度、胎盘后低回声带是否消失、膀胱线是否连续、胎盘陷窝性状、胎盘基底血流信号、宫颈形态是否完整、宫颈是否存在血窦,以及剖宫产史等项目,每项评 0-2 分,计算总分值。计算不同类型胎盘植入患者超声评分量表的临界值,并比较各类型患者术中出血量及子宫切除率。**结果:** 60 例患者中粘连型 38 例、植入型 13 例、穿透型 9 例。粘连型出血量低于重型($P<0.01$),在重型患者中,植入型与穿透型术中出血量无差异($P=0.360$)。粘连型患者均未切除子宫。粘连型与重型子宫切除率相比有差异($P<0.01$),重型高于粘连型。其中植入型子宫切除率低于穿透型($P<0.01$)。粘连型超声评分低于重型($P<0.01$)。重型患者中,植入型超声评分又低于穿透型($P<0.01$)。受试者工作特性曲线显示:当 AUC 为 90.5%、评分 ≥ 2.5 时,敏感度为 92.3%,特异度为 73.7%,粘连型和植入型的最佳临界值为 3 分;当 AUC 为 73.5%、评分 ≥ 9.5 分时,敏感度为 55.6%,特异度为 76.9%,因此确定植入和穿透型的界值为 10 分;当 AUC 为 78.0%、评分 ≥ 2.5 时,敏感度为 72.7%,特异度为 88.2%,是否出现产后出血的最佳临界值为 3 分。**结论:** 超声影像学可评估胎盘植入的程度,并预测术中出血及子宫切除的风险。以评分 3 分为界,用以预测粘连和重型胎盘植入、产后出血的发生。以评分 ≥ 10 分为界,用以预测植入型和穿透型胎盘植入。其中,评分 ≥ 10 分时,穿透型植入可能性大。

关键词: 超声影像学; 胎盘植入; 程度

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The Risk of Placenta Accreta by Ultrasound Imaging and Its Correlation with Placenta Accreta*

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ABSTRACT Objective: To investigate risk of placenta accreta by ultrasound imaging and its correlation with placenta accreta. **Methods:** Retrospective analysis of the clinical data of 80 patients with placenta accreta hospitalized in our hospital from January 2017 to December 2019. Analysis of the characteristics of ultrasound imaging before delivery, according to the location and thickness of placenta, whether the low gyrus after placenta disappeared, whether the bladder line is continuous, placental socket character, placental basal blood flow signal, cervical morphology is complete, presence of blood sinus, and the history of cesarean section and other items, each evaluation 0-2 points, calculate the total score. The critical value of ultrasound scale for different types of placenta accreta patients was calculated and the intraoperative bleeding volume and hysterectomy rate were compared. **Results:** Of the 60 cases, 38 were adhesive type, 13 were implant type and 9 were penetrating type. Implantation type, penetrating type collectively referred to as heavy placenta accreta. The bleeding volume of adhesion type was lower than that of severe type($P<0.01$). In severe patients, there was no statistically significant difference of intraoperative bleeding volume between implant type and penetrating type($P=0.360$). The uterus was not excised in the patients with adhesion. Compared with the rate of severe hysterectomy, the difference was statistically significant ($P<0.01$), and the heavy type was higher than the adhesive type. Among them, the rate of implantation hysterectomy (15.3%) was lower than that of penetration type (44.4%, $P<0.01$). The adhesion ultrasound score was lower than that of heavy ($P<0.01$). The implantable ultrasound score was also lower than the penetrant type ($P<0.01$). When the AUC was 90.5%, the score ≥ 2.5 , the sensitivity was 92.3%, the specificity was 73.7%, the optimal critical value of adhesion type and implant type was 3 points; when the AUC was 73.5%, the score was 9.5, the sensitivity was 55.6%, and the specificity was 76%. Thus, the threshold for implant and penetration was determined to be 10; when the AUC was 78.0%, the score ≥ 2.5 , the sensitivity was 72.7%, the specificity was 88.2%, and the optimal threshold for postpartum hemorrhage was 3. **Conclusion:** Ultrasound imaging can assess the extent of placenta accreta and predict the risk of intraoperative bleeding and hysterectomy. Score 3 was used to predict the occurrence of adhesion and severe (including implantation and penetration) placenta accreta and postpar-

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tum hemorrhage. A score ≥ 10 was used to predict implantable and penetrating placental implantation. Among them, when the score ≥ 10 , the possibility of penetrating implant is great.

Key words: Ultrasonography; Placental Implantation; Degree

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前言

胎盘植入是一种由于子宫蜕膜发育异常导致的胎盘绒毛膜侵入子宫肌层甚至浆膜层^[1]。根据胎盘侵入的深度分为 3 种类型:① 粘连型:最常见,约占 75 %~80 %,绒毛附着于子宫肌层。② 植入型:约占 15 %,绒毛侵入部分子宫肌层。③ 穿透型:约占 5 %~7 %,绒毛侵入子宫肌层穿透子宫肌壁直达浆膜,造成子宫破裂^[2]。植入型和穿透型较黏连型凶险,在临床中需着重排除^[3]。不同类型的胎盘植入均可导致产后大量出血、子宫破裂、感染等,严重危及母婴健康及孕妇生命^[4]。随着二胎政策的实施,剖宫产率逐年增加,胎盘植入的发生率也逐渐上升。20 世纪 60 年代,随着超声影像学的发展,超声技术开始用于检查胎儿及其附属物,胎盘植入的检出率有所升高,但目前为止,及时、快速的诊断胎盘植入及对胎盘植入程度进行合理的评估仍然是一个难题^[5]。超声影像学以其快速、简便、无创的特点,成为诊断胎盘植入的首选方法^[6]。相关研究表明,分娩前及时诊断并评估胎盘植入的程度,对于改善妊娠结局,挽救孕妇及胎儿的生命,提高生存质量至关重要^[7]。既往报道阴道超声可用于胎盘植入的检测,但其准确性尚未可知^[8]。随着超声技术的发展,彩色多普勒血流观察胎盘实质以及周围血流情况,使胎盘植入的诊断有了价值^[9]。本文就超声影像学对胎盘植入程度的评估及其相关性进行以下研究。

1 资料与方法

1.1 一般资料

回顾性分析 2017 年 7 月 -2020 年 7 月于我院住院治疗的 60 例产后经临床或病理证实的胎盘植入患者(植入型和穿透型统称"重型")。其中粘连型 24,植入型 32,穿透型 4。年龄 21~45 岁,平均年龄(35.6 $\pm$ 5.4)岁。4 例穿透型患者行病理检查,32 例植入型中 15 例(46.9 %)行病理检查,24 例粘连型未行病理检查。

1.2 资料分析

收集产前及产后临床资料,包括产后出血史、胎盘植入史、宫腔粘连史等。

1.3 超声检查和评分

使用 GEVolution E10、GEVolution E8 彩色多普勒超声诊断仪,探头频率 3.5 MHz。孕妇仰卧位,检查前膀胱充盈约 300 mL。经腹部对胎盘进行纵切面、横切面、斜切面的多切面扫查,注意胎盘位置、厚度、胎盘后低回声带是否完整连续;膀胱线是否完整,胎盘实质内是否存在多个大小不等的无回声(即胎盘陷窝),陷窝内是否有快速射流的血流(存在时为"沸水征"),注意宫颈形态是否完整,以及宫颈内和周边的血流情况。编制评分表,对各项观察项目,按其严重程度分别评 0-2 分;再根据是否有剖宫产史,加 0-2 分。最后计算总分值。具体评分量表见表 1^[10]。超声检查均由年资较高、有经验的医师完成。

表 1 胎盘植入超声评分量表
Table 1 Ultrasound score of placenta accreta

	0	1	2
Placental location	Normal	Marginal or low placement (less than 2 cm from cervical)	Full front
Placental thickness (cm)	<3	3-5	>5
Hypocortical vocal cord after placenta	Continuous	Local interrupt	Disappeared
Bladder line	Continuous	Interrupt	Disappeared
Placental trap	No	Yes	Fusion into pieces, with "boiling water"
Blood flow signal of placental basement	Basal blood flow rule	Basal blood flow increased and massed	The emergence of "transboundary" blood vessels
Cervical sinuses	No	Yes	Fusion into pieces, with "boiling water"
Cervical morphology	Complete	Incomplete	Disappeared
History of cesarean section	No	1	≥ 2

1.4 诊断标准

胎盘植入诊断标准:自然分娩时,第 3 产程经积极处理至少 20 min,胎盘不能自行剥离,徒手剥离时发现胎盘与子宫壁

粘连,甚至剥离操作困难、胎盘破碎。剖宫产术中,胎盘不能自行剥离,徒手剥离时证实胎盘粘连或植入。剖宫产术中胎盘附着部位存在胎盘植入并残留,该部位发生严重出血需缝扎局

部止血、切除部分子宫壁以保留子宫或需行子宫全切除术^[11]。需超声影像学检查及病理检查进行进一步确诊。

宫腔粘连程度参考中国宫腔粘连诊断分级评分标准^[12]。胎儿娩出后 24 h 内失血量超过 500 mL, 剖宫产时超过 1000 mL 即为产后出血^[13]。

1.5 统计学方法

采用 SPSS22.0, 计量资料用($\bar{x} \pm s$)表示, 采用方差分析。计数资料用%表示, 采用 χ^2 检验。采用受试者工作特性(receiver operating characteristic, ROC)曲线计算各类型的评分界值。 $P < 0.05$ 有统计学意义。

表 2 不同类型胎盘植入患者术中出血量、子宫切除率、超声评分的比较

Table 2 Comparison of intraoperative blood loss, hysterectomy and ultrasound scores in patients with different types of placenta accreta

Type	n	Intraoperative bleeding [M (min-max), mL]	Hysterectomy (%)	Ultrasound score ($\bar{x} \pm s$, points)
Heavy duty	22	1515(300-2500)*	6(27.2)*	7.12 $\pm$ 2.23*
Implant type	13	1200(300-2100)*	2(15.3)*#	6.18 $\pm$ 2.52*#
Type of penetration	9	1600(500-2500)*	4(44.4)*	8.67 $\pm$ 2.64*
Adhesion type	38	300(100-600)	0	1.86 $\pm$ 1.56

Note: * $P < 0.01$ compared with adhesion type; # $P < 0.01$ compared with penetration type.

2.2 预测粘连型与植入型胎盘植入患者超声评分临界值的 ROC 曲线

AUC 为 90.5%, 当超声评分 ≥ 2.5 分时, 敏感度 92.3%, 特异度 73.7%, 约登指数为 0.581。故当超声评分 ≥ 3 分时考虑为植入型, < 3 分时为粘连型, 见图 1。

2.3 预测植入型与穿透型胎盘植入患者超声评分临界值的 ROC 曲线

AUC 为 73.5%, 当超声评分 ≥ 9.5 分时, 敏感度为 55.6%,

2 结果

2.1 不同类型胎盘植入患者术中出血量、子宫切除率和超声评分系统比较

术中出血量: 粘连型低于重型($P < 0.01$), 植入型与穿透型比较无差异($P = 0.360$)。子宫切除率: 粘连型未切除子宫。粘连型与重型子宫切除率有差异($P < 0.01$), 重型高于粘连型, 其中植入型 15.3% 切除子宫, 穿透型 44.4% 切除子宫, 两组有差异($P < 0.01$)。超声评分系统: 粘连型低于重型($P < 0.01$), 重型患者中植入型评分低于穿透型($P < 0.01$), 见表 2。

特异度为 76.9%, 约登指数为 0.325。因此确定植入和穿透型的界值为 10 分, 即 ≥ 10 分时考虑为穿透型, < 10 分考虑为植入型, 见图 2。

2.4 预测产后出血患者超声评分临界值的 ROC 曲线

AUC 为 0.780, 当超声评分 ≥ 2.5 时, 敏感度为 72.7%, 特异度为 65.4%, 约登指数为 0.381。因此, 产后出血的界值为 3 分, 即 ≥ 3 分发生产后出血, < 3 分一般不发生后出血, 详见图 3。

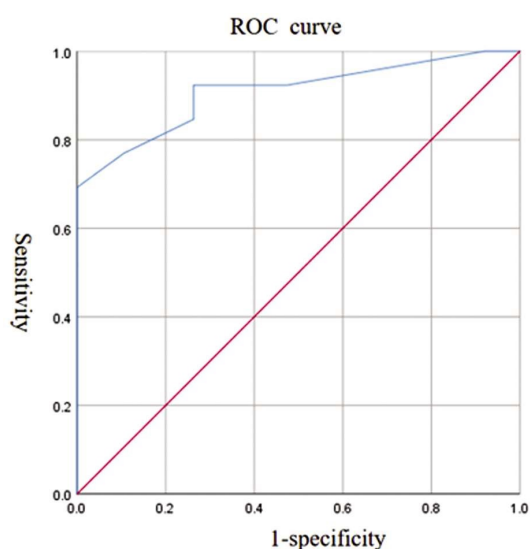


图 1 粘连型与植入型胎盘植入患者超声评分临界值的 ROC 曲线
Fig.1 ROC of the subjects with the critical value of ultrasound score in patients with adhesive and implanted placenta accreta

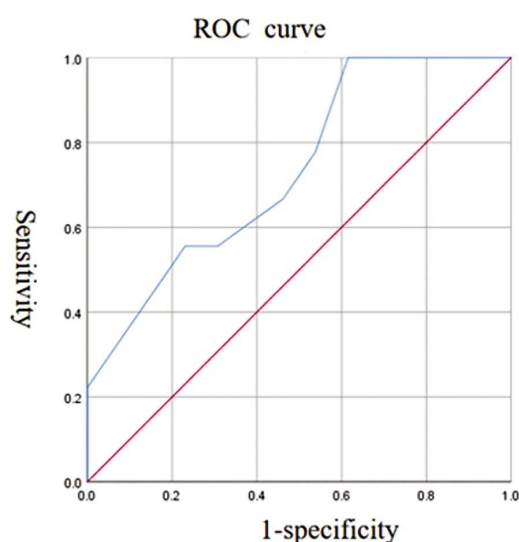


图 2 植入型与穿透型胎盘植入患者超声评分临界值的 ROC 曲线
Fig.2 ROC of the subjects with the critical value of ultrasound score in patients with implantable and penetrating placenta accreta

3 讨论

胎盘植入本质上来说是一种并发症, 发生几率相当高, 可

引起产后出血、休克、早产, 严重时直接威胁到母婴安全^[14]。相关研究发现高龄、剖宫产以及产褥期感染等, 都是导致胎盘植入的高危因素^[15]。胎盘植入发生率较低, 仅占 0.004%, 但在高

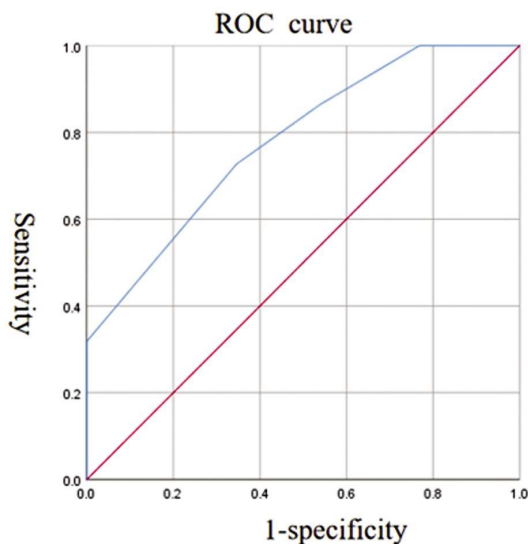


图3 产后出血患者超声评分临界值的 ROC 曲线

Fig.3 ROC of the subjects with the critical value of ultrasound score in patients with postpartum hemorrhage

危孕妇中的发生率显著升高^[16]。胎盘附着部位血流交换异常引起的蜕膜发育缺陷以及胎盘附着位置异常是胎盘植入的主要原因^[17]。胎盘植入在育龄期妇女行子宫切除的疾病中, 约占73.7%, 可引起致命性并发症^[18]。近年来规范的孕期检查已经全面普及, 有助于产科医生及时与患者沟通交流, 制定后续的个性化诊疗方案, 选择终止妊娠时机, 评估风险等方面具有至关重要的作用^[19]。目前, 尚无有效预测胎盘植入的辅助检查手段及统一标准。超声影像学以其经济、安全、方便等优点成为胎盘植入的主要检查方式^[20]。种轶文等^[21]回顾性分析180例胎盘植入孕妇的临床资料, 针对其影像学特点, 制定了超声评分量表, 得到了广大学者的认可。

研究发现, 胎盘植入的产妇死亡率高达10%, 对产妇的危害极大, 同时胎盘植入使得产妇发生产后出血等不良并发症的风险也增加^[22]。Cali等^[31]对187例剖宫产术后再次妊娠合并前置胎盘的患者研究, 发现超声对于诊断胎盘植入具有较高的阳性及阴性预测值, 可以进行具体分型。刘佩沙等^[23]研究发现超声诊断植入型胎盘准确率为87.0%, 漏诊率为13.0%。郭蓉等^[24]认为胎盘植入的超声影像学表现主要为胎盘增厚、胎盘内可见旋涡等, 其准确率为83.3%。因此, 超声不仅可以诊断胎盘植入, 还对植入类型具有一定的评估价值^[25]。由于胎盘植入的超声影像学表现复杂, 可能受多种因素的影响, 对超声影像的显著征象给予量化考核, 可对判定胎盘植入的类型具有显著的警示作用^[26]。有研究人员将超声影像学与剖宫产史相结合来评估胎盘植入的类型及预测出血风险^[27]。

本研究中, 重型胎盘植入的术中出血量明显大于黏连型, 而植入型与穿透型无明显差异; 黏连型未发生子宫切除, 穿透型子宫切除率高于植入型; 重型超声评分高于黏连型, 穿透型超声评分高于植入型。提示与黏连型相比, 重型胎盘植入危险性较高; 与植入型相比, 穿透型不良反应较严重, 危险性较高。可能由于重型胎盘植入尤其是穿透型胎盘植入患者的胎盘不能完全剥离, 子宫收缩力差, 常需借用剪刀等器械清除植入的胎盘, 可能伤及子宫肌壁, 导致部分子宫肌层变薄, 甚至造成子宫

壁的缺失, 导致术后大出血及子宫切除的发生^[28]。

本研究通过单中心的临床研究, 初步制订了“胎盘植入超声评分量表”。将胎盘植入按照超声影像学特征, 以不同分值为界值, 预测胎盘植入的类型。超声评分 ≥ 3 时, 发生植入型胎盘植入的可能性大, 粘连型胎盘植入的可能性较小, 不易发生产后出血。当超声评分 ≥ 10 分时, 穿透型胎盘植入的可能性大。评分越高, 出血风险越高, 子宫切除可能性越大。产科医生可根据评分, 决定终止妊娠时机, 尽量延长孕周, 减少并发症, 避免胎盘植入穿透子宫浆膜面导致的腹腔内恶性出血^[29]。根据胎盘植入程度, 预测术中出血量, 备好血量, 保证充足的血液供应, 防止休克的发生, 减少血液浪费^[30]。

本研究属于回顾性研究, 超声影像学检查可对胎盘进行全面、细致的检查, 获取胎盘的全面信息, 得到完整图像。超声评分法包含多种参数, 为产前咨询和术前准备提供了极为重要的参考价值, 对指导临床治疗具有重要意义^[31]。但样本量相对较少, 且为单中心研究, 所得结果难免存在信息偏倚、选择偏倚。未来期待多中心前瞻性研究, 以对这一超声评分进行深入验证, 以期对临床的诊断及治疗带来新的参考。

参考文献(References)

- [1] Matsika A. Clinical correlates of histopathological entities of the placenta[J]. Aust J Gen Pract, 2021, 50(1-2): 62-69
- [2] Hu M, Li J, Baker PN, et al. Revisiting Preeclampsia: a Metabolic Disorder of the Placenta[J]. FEBS J, 2021, 2: e15745
- [3] Bartho LA, Fisher JJ, Cuffe JSM, et al. Mitochondrial transformations in the aging human placenta [J]. Am J Physiol Endocrinol Metab, 2020, 319(6): E981-E994
- [4] Lim G, Horowitz JM, Berggruen S, et al. Correlation of probability scores of placenta accretion magnetic resonance imaging with hemorrhagic morbidity[J]. J Clinical Anesthesia, 2016, 34: 261-269
- [5] 韩瑞征, 张君玲, 栗河舟, 等. 胎盘植入的产前超声诊断分析[J]. 医学研究生学报, 2018, 31(9): 1001-1004
- [6] Maron JL. Giving the Placenta the Respect It Deserves [J]. Clin Ther, 2021, S0149-2918(21)00002-3
- [7] Ishibashi H, Miyamoto M, Shinmoto H, et al. Applicability of ultrasonography for detection of marginal sinus placenta previa [J]. Medicine (Baltimore), 2021, 100(1): e24253
- [8] Rajasekaran K, Dadhwal V, Jassim M. Incidental diagnosis of sad fetus syndrome in triplets[J]. BMJ Case Rep, 2021, 14(2): e238977
- [9] Lu Y, Meng L, Ma D, et al. The occurrence of PFAS in human placenta and their binding abilities to human serum albumin and organic anion transporter 4[J]. Environ Pollut, 2021, 273: e116460
- [10] 王勇. 试论胎盘植入的产前超声诊断及影响因素[J]. 世界最新医学信息文摘, 2019, 19(20): 170-173
- [11] Milovanov AP, Bushtarev AV, Fokina TV. Osobennosti tsitotrofoblasticheskogo invazii pri polnom predlezhanii i vrastanii platsenty[J]. Arkh Patol, 2017, 79(6): 30-35
- [12] 李明明, 邓艳蕾, 钟少卫, 等. 二维、三维超声综合评分法诊断宫腔粘连的临床价值[J]. 中国妇幼保健, 2018, 33(23): 5604-5607
- [13] Silver RM, Barbour KD. Placenta accreta spectrum: accreta, increta, and percreta[J]. Obstet Gynecol Clin North Am, 2015, 42(2): 381-402
- [14] Hu M, Li J, Baker PN, et al. Revisiting Preeclampsia: a Metabolic Disorder of the Placenta [J]. FEBS J, 2021, S0149-2918(20)30565-8

- [15] Abu Hashim H, Shalaby EM, Hussien MH, et al. Diagnostic accuracy of the placenta accreta index for placenta accreta spectrum: a prospective study[J]. *Int J Gynaecol Obstet*, 2021, 20: e13610
- [16] Redline RW. The clinical implications of placental diagnoses [J]. *Semin Perinatol*, 2015, 39(1): 2-8
- [17] Liu B, Deng S, Lin M, et al. Prediction of cesarean hysterectomy in placenta previa complicated with prior cesarean: a retrospective study [J]. *BMC Pregnancy Childbirth*, 2020, 20(1): e81
- [18] Xie RH, Zeng S, Zhou L, et al. Comparison of Adverse Maternal and Neonatal Outcomes in Women Affected by Placenta Previa With and Without a History of Cesarean Delivery: A Cohort Study [J]. *J Obstet Gynaecol Can*, 2021, 23: S1701-2163(21)00062-1
- [19] Jauniaux E, Ayres-de-Campos D. FIGO Placenta Accreta Diagnosis and Management Expert Consensus Panel.FIGO consensus guidelines on placenta accreta spectrum disorders:Introduction[J]. *Int J Gynaecol Obstet*, 2018, 140(3): 261-264
- [20] M Hussein A, Kamel A. Reply to letter to the editor article "Placenta accreta spectrum: "placenta accreta" is still used" [J]. *Arch Gynecol Obstet*, 2021, 3: s404
- [21] 种轶文,张爱青,王妍,等.超声评分系统预测胎盘植入凶险程度的价值[J].*中华围产医学杂志*, 2016, 19(9): 705-709
- [22] 卢红梅,孙丽洲,葛志平.择期手术和急诊手术对胎盘植入治疗的效果及妊娠结局[J].*中国妇幼保健*, 2014, 29(5): 674-677
- [23] 刘佩沙,罗友,徐向英,等.超声检查在植入性凶险型前置胎盘诊断中的价值[J].*安徽医学*, 2016, 37(11): 1378-1380
- [24] 郭蓉,张雯娟.前置胎盘并发胎盘植入中产前超声诊断分析[J].*医学综述*, 2015, 21(1): 169- 171
- [25] Fadl SA, Linnau KF, Dighe MK. Placental abruption and hemorrhage-review of imaging appearance [J]. *Emerg Radiol*, 2019, 26(1): 87-97
- [26] Shainker SA, Coleman B, Timor-Tritsch IE, et al. Society for Maternal-Fetal Medicine. Electronic address: pubs@smfm.org. Special Report of the Society for Maternal-Fetal Medicine Placenta Accreta Spectrum Ultrasound Marker Task Force: Consensus on definition of markers and approach to the ultrasound examination in pregnancies at risk for placenta accreta spectrum[J]. *Am J Obstet Gynecol*, 2021, 224(1): B2-B14
- [27] Lopes ES, Feitosa FEL, Brazil AV, et al. Assessment of Sensitivity and Specificity of Ultrasound and Magnetic Resonance Imaging in the Diagnosis of Placenta Accreta [J]. *Rev Bras Ginecol Obstet*, 2019, 41(1): 17-23
- [28] Matoba N, Mestan KK, Collins JW Jr. Understanding Racial Disparities of Preterm Birth Through the Placenta [J]. *Clin Ther*, 2021, 19: S0149-2918(20)30562-2
- [29] De Vita D, Capobianco G, Gerosolima G, et al. Clinical and Ultrasound Predictors of Placenta Accreta in Pregnant Women with Antepartum Diagnosis of Placenta Previa: A Multicenter Study [J]. *Gynecol Obstet Invest*, 2019, 84(3): 242-247
- [30] Cheung W, Stevenson GN, de Melo Tavares Ferreira AEG, et al. Feasibility of image registration and fusion for evaluation of structure and perfusion of the entire second trimester placenta by three-dimensional power Doppler ultrasound[J]. *Placenta*, 2020, 94: 13-19
- [31] Cali G, Forlani F, Lees C, et al. Prenatal ultrasound staging system for placenta accreta spectrum disorders [J]. *Ultrasound Obstet Gynecol*, 2019, 53(6): 752-760

(上接第 4343 页)

- [16] 张冬雪,姜涛,傅月玥,等.原发性甲状旁腺功能亢进症 84 例临床病理分析[J].*诊断病理学杂志*, 2017, 24(7): 481-485
- [17] Guilmette J, Sadow PM. Parathyroid Pathology [J]. *Surg Pathol Clin*, 2019, 12(4): 1007-1019
- [18] Masi L. Primary Hyperparathyroidism[J]. *Front Horm Res*, 2019, 51: 1-12
- [19] Cinque L, Pugliese F, Salcuni S, et al. Molecular pathogenesis of parathyroid tumours [J]. *Best Pract Res Clin Endocrinol Metab*, 2018, 32(6): 891-908
- [20] Vestergaard P, Thomsen Sv. Medical treatment of primary, secondary, and tertiary hyperparathyroidism [J]. *Curr Drug Saf*, 2011, 6(2): 108-113
- [21] Oberger Marques JV, Moreira CA. Primary hyperparathyroidism[J]. *Best Pract Res Clin Rheumatol*, 2020 Apr 23
- [22] Fisher SB, Perrier ND. Primary hyperparathyroidism and hypertension[J]. *Gland Surg*, 2020, F9(1): 142-149
- [23] Li M, Li Y, Deng W, et al. Chinese bone turnover marker study: reference ranges for C-terminal telopeptide of type I collagen and procollagen IN-terminal peptide by age and gender [J]. *PLoS One*, 2014, 9:103841
- [24] 陈敏敏,杜艳萍,洪维,等.钙补充、年龄及性别对上海社区老年人血清 25 羟维生素 D 与甲状旁腺素关系的影响[J].*中华骨质疏松和骨矿盐疾病杂志*, 2016, 9(4): 339-345
- [25] Saliba W, Lavi I, Rennert HS, et al. Vitamin D status in primary hyperparathyroidism[J]. *Eur J Intern Med*, 2012, 23: 88-92
- [26] 张婷婷,庞田田,李游山,等.甲状旁腺激素的基因表达调控[J].*生理科学进展*, 2016, 47(3): 231-234
- [27] Duan K, Gomez Hernandez K, Mete O. Clinicopathological correlates of hyperparathyroidism[J]. *J Clin Pathol*, 2015, 68(10): 771-787
- [28] 胡琴,胡蜀红. 89 例原发性甲状旁腺功能亢进症患者的诊治分析[J]. *中华内分泌代谢杂志*, 2015, 31(4):300-305
- [29] Greenberg AK, Yee H, Rom WN. Preneoplastic lesions of the lung [J]. *Respir Res*, 2002, 3(1): 20
- [30] 张爽,代文杰.原发性甲状旁腺功能亢进术中甲状旁腺激素检测的应用和进展[J].*临床外科杂志*, 2018, 26(6): 469-471