

doi: 10.13241/j.cnki.pmb.2022.02.036

超声诊断持续性右脐静脉合并畸形的价值及其对于胎儿预后意义研究 *

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摘要 目的:探讨超声诊断持续性右脐静脉(PRUV)合并畸形的价值及其对于胎儿预后意义研究。**方法:**收集我院 2014 年 1 月至 2020 年 1 月定期产检的孕妇 6258 例。对所有胎儿行超声心动图产前评估,对发现存在 PRUV 的胎儿进一步确诊。对所有 PRUV 病例进行胎儿超声心动图详细的解剖扫描,以确定是否合并有其他畸形。在我院分娩的孕妇病例系统均详细记录有孕妇和胎儿的住院情况。对未在我院分娩的 PRUV 胎儿进行电话随访,以了解胎儿出生时的情况。对 26 例 PRUV 胎儿均进行了至少为期 12 个月的电话随访,以了解胎儿的预后情况。**结果:**PRUV 超声表现为脐静脉向胆囊外侧和右侧走行,可能与向胃方向走行的右门静脉融合(肝内型),也可能流入右心房、下腔静脉心下部分或髂静脉(肝外型)。在肝内型变异中,脐静脉与右门静脉在静脉窦处融合,胎盘血液继续流入静脉导管,最终流入下腔静脉。在 6258 例定期产检孕妇中共发现 26 例患有 PRUV 的胎儿,PRUV 发生率为 0.42%(26/6258),其中肝内型为 0.39%(24/6258),肝外型为 0.03%(2/6258)。单纯型 PRUV 胎儿(除 PRUV 外不合并其他畸形)16 例,占 61.54%(16/26),其中 1 例因胎儿体重过大行剖腹产,产后胎儿健康;其余胎儿均自然分娩,产后胎儿健康。非单纯型 PRUV 胎儿(除 PRUV 外合并其他畸形)10 例,占 38.46%(10/26),其中 8 例为肝内型 PRUV,2 例为肝外型 PRUV。8 例非单纯型肝内型 PRUV 中,法洛三联症伴单脐动脉胎儿生后手术治疗,预后较差,1 岁时因感染性心内膜炎死亡;房间隔缺损生后随访自行关闭,胎儿健康;其余胎儿生后手术治疗,预后良好。2 例非单纯型肝外型 PRUV 分别合并肢端畸形和大动脉转位,1 例宫内死亡,1 例剖腹产后 1 周因心力衰竭死亡。**结论:**详细的产前超声检查可用于确诊 PRUV 及其可能合并畸形。单纯型 PRUV 胎儿预后良好,非单纯型 PRUV 胎儿预后则取决于伴随畸形的类型和严重程度,且非单纯型肝外型 PRUV 预后不佳、死亡率较高。

关键词:超声心动图;持续性右脐静脉;畸形;胎儿;预后

中图分类号:R445.1;R714.53 **文献标识码:**A **文章编号:**1673-6273(2022)02-383-05

The Value of Ultrasonography in the Diagnosis of Persistent Right Umbilical Vein with Malformation and Its Prognostic Significance for Fetus*

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ABSTRACT Objective: To investigate the value of ultrasonography in the diagnosis of persistent right umbilical vein (PRUV) with malformation and its prognostic significance for fetus. **Methods:** A total of 6258 pregnant women were collected from our hospital during January 2014 to January 2020. Prenatal evaluation with echocardiography was performed on all fetuses, and further diagnosis was made in fetuses with PRUV. Detailed fetal echocardiographic anatomic scans were performed in all PRUV cases to determine the presence of additional malformations. Hospitalization of pregnant women and their fetuses was recorded in detail in the system of maternal cases delivered in our hospital. The PRUV fetuses that were not delivered in our hospital were followed up by telephone to understand the condition of the fetuses at birth. All 26 PRUV fetuses were followed up by telephone for at least 12 months to understand the prognosis of the fetuses. **Results:** PRUV ultrasound showed that the umbilical vein ran laterally and to the right side of the gallbladder, and may fuse with the right portal vein running toward the stomach (intrahepatic type), or may drain into the right atrium, inferior part of the inferior vena cava, or iliac vein (extrahepatic type). In the intrahepatic variant, the umbilical vein fuses with the right portal vein at the venous sinus, and placental blood continues to flow into the venous duct and eventually into the inferior vena cava. A total of 26 fetuses with PRUV were found in 6258 pregnant women with regular antenatal examination, the incidence of PRUV was 0.42%(26/6258), of which the intrahepatic type was 0.39%(24/6258) and the extrahepatic type was 0.03% (2/6258). There were 16 (61.54%) cases were PRUV simplex fetuses (except PRUV without other malformations), in which 1 case was delivered by caesarean section due to fetal weight, and the post-

* 基金项目:国家自然科学基金项目(30500478);重庆市科委科研基金项目(cstc2015jcyjA10327)

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(收稿日期:2021-05-21 接受日期:2021-06-18)

partum fetus was healthy. All the other fetuses were delivered naturally and the postpartum fetuses were healthy. There were 10 (38.46%) cases of non-simple PRUV fetuses (except PRUV with other malformations), including 8 cases of intrahepatic PRUV and 2 cases of extrahepatic PRUV. In 8 cases of PRUV of non-simple intrahepatic type, the fetuses with tetralogy of Fallot and single umbilical artery were surgically treated after birth, and the prognosis was poor and they died of infective endocarditis at the age of 1 year. Atrial septal defect closed spontaneously after birth and the fetus was healthy. The prognosis of the other fetuses was good after the operation. 2 cases of non-simple extrahepatic PRUV were combined with acromitis and transposition of the great artery, 1 case died intrauterine and the other died of heart failure 1 week after cesarean section. **Conclusion:** Detailed prenatal ultrasound may be used to confirm PRUV and its possible concomitant deformities. The prognosis of PRUV fetuses is good with simple PRUV fetuses, and the prognosis of PRUV fetuses with non-simple PRUV fetuses depends on the type and severity of the associated malformations, and the prognosis of PRUV fetuses with non-simple extrahepatic PRUV is poor and the mortality rate is high.

Key words: Ultrasonic cardiogram; Persistent right umbilical vein; Malformation; Fetus; Prognosis

Chinese Library Classification(CLC): R445.1; R714.53 **Document code:** A

Article ID: 1673-6273(2022)02-383-05

前言

持续性右脐静脉(PRUV)是胚胎发育过程中发生的一种病理血管异常,表现为右脐静脉持续存在,而左脐静脉闭塞^[1-3]。脐静脉的异常可能与胚胎结构的持续性异常和多生血管有关^[4-6]。PRUV病因尚不清楚,但血栓阻塞、致畸物或叶酸缺乏可能是其致病因素^[7-9]。在产前超声检查中可通过胎儿腹部横切面进行PRUV诊断。在1990年,Jeanty P等^[10]首次报道PRUV时被认为是一种罕见的异常结构,经常与其他系统的畸形合并出现,但近年来随着对胎儿静脉系统检查认识的提高和超声技术的进步,研究发现PRUV并不是一种非常罕见的情况,其发病率约为0.08%-0.5%^[11,12]。此外,多数情况下PRUV不合并其他系统的畸形,伴随畸形率约为13%-40.9%^[13]。研究显示,单纯型PRUV胎儿预后良好^[4,7,11-14];但PRUV可能与先天性静脉导管缺失和其他严重的胎儿畸形有关。目前,有关PRUV的超声诊断及胎儿预后评估的研究尚少,此外不同研究PRUV的发生率不同,且具体发病机制和病因尚不明确。因此,本研究旨在探讨PRUV合并畸形的超声诊断价值及其胎儿预后情况,现报道如下。

1 资料与方法

1.1 一般资料

收集我院2014年1月至2020年1月定期产检的孕妇6258例,孕周16周-40周,均为单胎妊娠,孕妇年龄22岁-37岁。所有胎儿超声心动图产前评估均由一名具有5年以上工作经验的超声医师进行,对发现存在PRUV的胎儿则进一步由另一名具有8年以上胎儿超声诊断工作经验的医师进一步确诊。在所有的PRUV病例中,进行胎儿超声心动图详细的解剖扫描,以确定是否合并有其他畸形。婴儿出生后,由儿科医生评估是否有其他异常。在超声检查中发现胎儿位置反转、位置不确定和异位的胎儿排除在外。最终确诊PRUV的胎儿26例。本研究经我院伦理委员会批准,并获得所有参与者及其家属的书面知情同意。

1.2 超声检查

使用GE Voluson E8超声机,配备超声频率为4-8 MHz的经腹凸体积传感器。每位患者均采用B型超声。静脉系统的扫

描包括目标血管的二维彩色多普勒成像。胎儿腹部横切面诊断PRUV。当发现异常病例时,视需要进行3D超声检查。在3D数据采集过程中,受试者屏住呼吸,使用介质壁过滤器和50%的增益,容积角设为55°。超声检查标准包括:①门静脉向胃方向的异常过程;②胎儿胆囊位于脐静脉的内侧;③脐静脉与向胃弯曲的门静脉的连接。

1.3 随访

在我院定期超声产检发现的26例确诊PRUV胎儿的孕妇中,有19例孕妇均在我院分娩,病例系统均详细记录有孕妇和胎儿的住院情况。对7例孕妇未在我院分娩的PRUV胎儿也进行电话随访,以了解胎儿出生时的情况,电话随访数据:孕妇年龄、妊娠次数、是否为试管婴儿、诊断PRUV时的胎龄、出生胎龄、新生儿出生体重、分娩方式、胎儿性别以及胎儿健康状况。对26例PRUV胎儿均进行了至少为期12个月的电话随访,随访最长时间者为18个月,以了解胎儿的预后情况。

1.4 统计学方法

采用SPSS 22.0统计分析软件。计量资料以均数 $\pm$ 标准差($\bar{x} \pm s$)表示。计数资料以频数和百分率表示。

2 结果

2.1 患PRUV胎儿的孕妇特征

诊断PRUV时孕妇年龄为24-36岁,平均(27.6 $\pm$ 3.5)岁;妊娠次数1-3次,平均妊娠次数为(1.8 $\pm$ 0.9)次;经产妇占65.38%(17/26);孕周16-28周,平均(22.5 $\pm$ 3.2)周。

2.2 PRUV超声表现

在6258例定期产检孕妇中共发现26例患有PRUV的胎儿,PRUV发生率为0.42%(26/6258),其中肝内型为0.39%(24/6258),肝外型为0.03%(2/6258)。脐静脉向胆囊外侧和右侧走行(图1),可能与向胃方向走行的右门静脉融合(肝内型,图2),也可能流入右心房、下腔静脉心下部分或髂静脉(肝外型,图3)。在肝内型变异中,脐静脉与右门静脉在静脉窦处融合,胎盘血液继续流入静脉导管,最终流入下腔静脉。

2.3 超声对PRUV合并畸形的诊断及胎儿结局

如表1所示,肝内型PRUV 24例,占92.31%(24/26),肝外型PRUV 2例,占7.69%(2/26)。单纯型PRUV胎儿(除PRUV外不合并其他畸形)16例,占61.54%(16/26),其中1例因胎儿

体重过大行剖腹产,产后胎儿健康;其余胎儿均自然分娩,产后胎儿健康。非单纯型 PRUV 胎儿(除 PRUV 外合并其他畸形) 10 例,占 38.46%(10/26),其中 8 例为肝内型 PRUV,2 例为肝外型 PRUV。8 例非单纯型肝内型 PRUV 中,2 例室间隔缺损、1 例室间隔缺损伴总动脉干、1 例唇腭裂、1 例房间隔缺损、1 例脐疝、1 例法洛四联症伴单脐动脉、1 例脊柱裂,其中法洛四联症伴单脐动脉胎儿生后手术治疗,预后较差,1 岁时因感染性心内膜炎死亡;房间隔缺损生后随访自行关闭,胎儿健康;其余胎儿生后手术治疗,预后良好;5 例行剖腹产,3 例自然分娩。2 例非单纯型肝外型 PRUV 分别合并肢端畸形和大动脉转位,1 例宫内死亡,1 例剖腹产后 1 周因心力衰竭死亡。

3 讨论

胎儿静脉系统在胎儿循环中起着关键作用,因为它将含氧

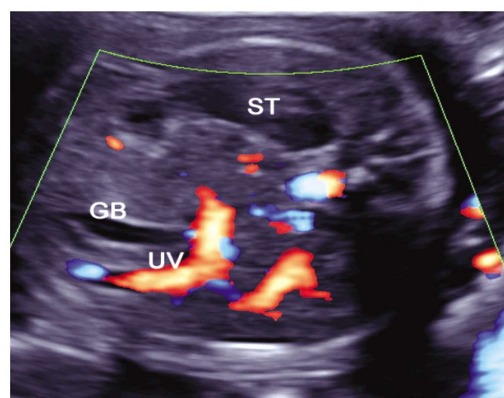


图 1 胎儿腹部横切面

Fig.1 Abdominal cross section of fetal abdomen

Note: Showed gallbladder (GB), adjacent umbilical vein (UV) turns to the stomach (ST), which was intrahepatic PRUV.

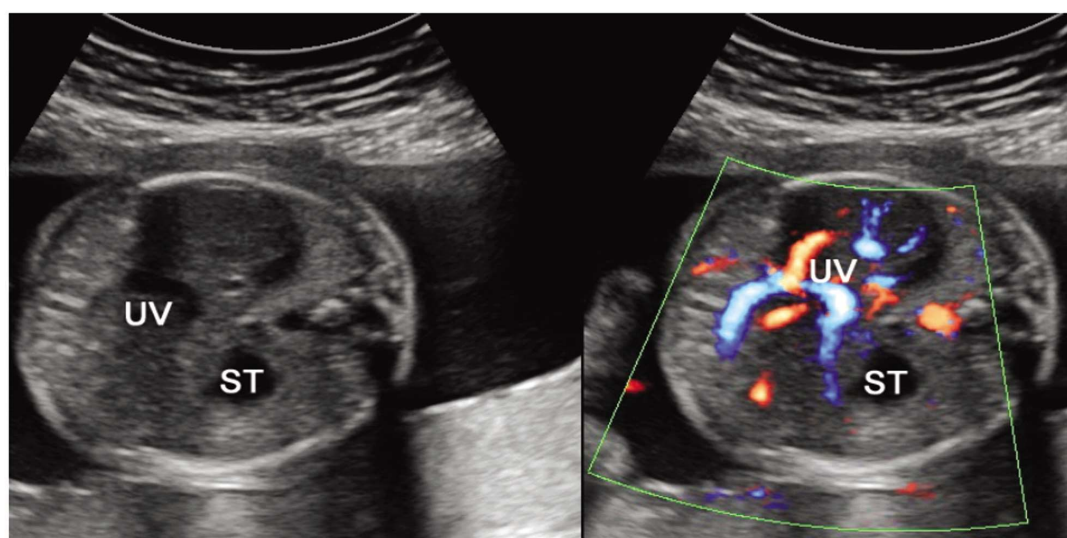


图 2 B 型(左)和彩色多普勒(右)胎儿腹部横切面

Fig.2 Abdominal cross section of fetal abdomen of type B (left) and color doppler (right)

Note: Showed that the umbilical vein (UV) turns to the stomach (ST), which was intrahepatic PRUV.



图 3 PRUV 在胎儿静脉系统的 3D 多普勒成像纵视图

Fig.3 3D Doppler imaging longitudinal view of PRUV in the fetal venous system

Note: Showed that the branches of hepatic vein were connected with inferior vena cava, which was extrahepatic PRUV.

血液运输到胎儿心脏^[15-17]。在早期发育中,两条脐静脉与静脉窦相连;右侧脐静脉在妊娠第四周开始逐渐消失,在妊娠第七周时完全消失;左侧脐静脉与胎儿肝内的左门静脉相连,然后运输所有血液^[18]。当右侧脐静脉呈持续打开状态时,它将含氧血液输送到心脏,可能与左侧脐静脉共存,作为肝内多生结构^[1]。PRUV 的临床意义取决于其类型和伴随的畸形,这些可能加重预后,影响妊娠分娩方式和结局。

沈国芳等^[9]在 15241 例连续性一般孕妇人群中研究发现 PRUV 胎儿的发生率为 0.32%,略低于本研究 0.42%,且均为肝内型。Krzyzanowski A 等^[1]在 2360 个研究对象中发现了 12 个患有 PRUV 的胎儿,发病率为 0.50%,略高于本研究 0.42%,且 25%(3/12)PRUV 胎儿合并其他畸形。不同研究胎儿 PRUV 的产前超声检出率不同,可能与不同研究人群样本及样本量有关,且孕妇无明显并发症及合并症,表明 PRUV 发病原因不明,应对每个孕妇进行常规脐静脉发育观察。当然,实际 PRUV 胎儿发病率可能会更高,可能因为胎儿位置和检查时间的限制而遗漏 PRUV;如果 PRUV 与显著异常相关,则可能在发现 PRUV 前就发生了胎儿宫内死亡,从而降低了检出率。PRUV

表 1 超声对 PRUV 合并畸形的诊断及胎儿结局

Table 1 Ultrasound diagnosis of PRUV combined with malformation and fetal outcome

Cases	Birth gestational age(w+d)	Birth weight(g)	Delivery method	Fetal gender	PRUV type	Combined malformation	Outcome after 18 months
1	37+4	3156	Natural childbirth	Male	Intrahepatic	No	Healthy
2	37+1	3520	Natural childbirth	Female	Intrahepatic	No	Healthy
3	38+2	4105	Caesarean birth	Male	Intrahepatic	Ventricular septal defect	Good prognosis after surgery
4	38+5	3362	Natural childbirth	Male	Intrahepatic	No	Healthy
5	36+6	3846	Natural childbirth	Male	Intrahepatic	Ventricular septal defect	Good prognosis after surgery
6	37+5	2965	Natural childbirth	Female	Intrahepatic	No	Healthy
7	39+1	2863	Natural childbirth	Female	Intrahepatic	No	Healthy
8	36+2	3501	Caesarean birth	Female	Intrahepatic	Ventricular septal defect with common trunk	Good prognosis after surgery
9	37+4	3108	Natural childbirth	Female	Intrahepatic	No	Healthy
10	38+2	4100	Natural childbirth	Male	Intrahepatic	Cheilopalatognathus	Healthy
11	38+5	4067	Natural childbirth	Male	Intrahepatic	No	Healthy
12	39+2	3702	Natural childbirth	Female	Intrahepatic	Atrial septal defect	Follow-up after birth, the atrial septal defect closed by itself, healthy
13	37+4	6320	Caesarean birth	Male	Intrahepatic	No	Healthy
14	38+4	3469	Natural childbirth	Male	Intrahepatic	No	Healthy
15	37+6	3326	Caesarean birth	Male	Intrahepatic	Umbilical hernia	Surgical treatment after birth, good prognosis
16	38+1	2946	Natural childbirth	Female	Intrahepatic	No	Healthy
17	38+3	3167	Natural childbirth	Female	Intrahepatic	No	Healthy
18	36+3	2640	Caesarean birth	Male	Intrahepatic	Tetralogy of Fallot with single umbilical artery	Surgical treatment after birth, poor prognosis, death due to infective endocarditis at 1 year old
19	37+6	2830	Natural childbirth	Male	Intrahepatic	No	Healthy
20	37+5	3100	Caesarean birth	Female	Intrahepatic	Spina bifida	Surgical treatment after birth, good prognosis
21	39+2	2900	Natural childbirth	Male	Intrahepatic	No	Healthy
22	38+6	3100	Natural childbirth	Female	Intrahepatic	No	Healthy
23	38+2	3510	Natural childbirth	Male	Intrahepatic	No	Healthy
24	37+4	3320	Natural childbirth	Male	Intrahepatic	No	Healthy
25	31+2	/	/	Male	Extrahepatic	Acromegaly deformity	Intrauterine death
26	36+2	3090	Caesarean birth	Female	Extrahepatic	Transposition of great arteries	Died from heart failure 1 week after birth

通常作为一种孤立性的静脉发育异常存在,然而其可能伴有胃肠道、心血管或泌尿生殖系统等其他畸形^[20,21]。PRUV 胎儿最常见的合并畸形是心血管畸形,其次是神经系统、泌尿系统、骨骼和其他异常^[13]。当 PRUV 胎儿患有单脐动脉时,其伴随胎儿心血管畸形和其他系统畸形的风险都会进一步增加^[13]。方锋凯等^[22]发现单脐静脉、PRUV 胎儿合并畸形的检出率均较高,并且畸

形种类较多,并且两者合并畸形主要是心脏、泌尿系统及神经系统异常等。因此临床上产前超声检查对于 PRUV 胎儿合并畸形的诊断尤为重要,对显著提高胎儿出生质量具有非常重要的价值。本研究显示,38.46%的 PRUV 胎儿存在其他系统的畸形。高于 Toscano P 等^[12]报道的 23.3%的合并畸形率和 Li J 等^[13]报道的 13.5%的合并畸形率,略低于 Martinez R 等^[23]报道的

40.9%的合并畸形率。在本研究中观察到 PRUV 胎儿合并其他畸形概率较多数研究高的原因可能为:首先,本研究纳入对象为我院连续性定期产前孕妇,包括了妊娠早中晚期的病例,而其他研究多集中在妊娠中期,此时 PRUV 胎儿伴随严重畸形可能在妊娠早期或中期已流产或已经停止在子宫内生长而使检出率减低。此外,部分研究未将单脐动脉纳入 PRUV 胎儿合并畸形中^[7],从而降低了合并畸形胎儿的比例。其次,PRUV 胎儿病因尚不明确,不同地区、不同研究人群、不同研究样本量研究得到的结果存在一定差异。因此,对于 PRUV 胎儿合并畸形的存在,可能不仅是脐静脉的解剖变异,同时可能是一个链接到胎儿心血管系统的发育异常或者可能是由一个共同的监管机制控制发展的神经系统、泌尿系统或骨骼系统等发育异常,但需要进一步深入的研究来证实。

PRUV 分为肝内型 PRUV 和肝外型 PRUV。肝内型 PRUV 是最常见的,发病率约 95%,这类脐静脉位于胆囊右侧面,与右侧门静脉连接,然后向胃部弯曲。肝内型 PRUV 通常存在静脉导管,在血流动力学方面有一点干扰,但预后良好^[24]。肝外型 PRUV 脐静脉直接与右心房或下腔静脉相连,与静脉导管不发育密切相关,预后较差^[25]。如果没有静脉导管,血液直接返回心脏,这可能会增加血流动力学负担,受影响的胎儿遭受容量超载和严重的血流动力学影响,导致胎儿积水^[26]。本研究结果显示,肝内型 PRUV 占 92.31%(24/26),肝外型 PRUV 占 7.69%(2/26);单纯型 PRUV 胎儿(除 PRUV 外不合并其他畸形)占 61.54%(16/26),除 1 例胎儿因体重过大行剖腹产外,其余胎儿均自然分娩,且所有胎儿产后均健康发育成长;非单纯型 PRUV 胎儿(除 PRUV 外合并其他畸形)占 38.46%(10/26),其中 8 例为肝内型 PRUV 中 1 例法洛四联症伴单脐动脉胎儿 1 岁时死亡,其余胎儿健康发育;2 例肝外型 PRUV 均死亡。Weichert J 等^[27]分析发现 74.8%均为单纯型 PRUV 胎儿,25.6%的肝内型 PRUV 胎儿合并其他系统畸形,而肝外型 PRUV 均合并有其他系统畸形,且预后均较肝内型 PRUV 差。上述结果表明,PRUV 胎儿是否伴随其他系统畸形、畸形的类型和严重程度直接决定了胎儿的预后。主要因为胎儿静脉系统在胎儿循环中起着关键作用,将含氧血液运输到胎儿心脏,很大一部分含氧血液直接从静脉导管通过卵圆孔到达左心房^[28]。先天性静脉导管的缺失可能与 PRUV 共存,导致调节失调和随后的容量超载,严重者可发生心脏肿大、羊水过多和积液^[29];此外不受限制的脐带血流进入全身静脉可能导致充血性心力衰竭,最终导致胎儿死亡^[27]。由于部分孕妇未作染色体核型分析,该部分随访结果不完整,不能有效评估 PRUV 与染色体核型是否具有相关性是本研究主要不足之处。

综上所述,在多数病例中,PRUV 是孤立性发生的,同时可能合并轻微或较严重的其他系统畸形,预后取决于 PRUV 类型和伴随畸形的严重程度。因此产前超声检查应重点观察胎儿静脉系统发育情况,在发现静脉解剖异常或功能异常时,进行详细的胎儿超声检查尤为重要,以排除其他畸形。

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