

· 临床研究 ·

超声联合放射学在新生儿胎粪性腹膜炎治疗方式评估中的价值

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[摘要] 目的:探讨超声联合放射学检查在新生儿胎粪性腹膜炎诊断及治疗方式选择中的作用。方法:回顾性分析2018年1月—2022年12月共83例确诊胎粪性腹膜炎的新生儿临床、超声以及放射学表现和治疗结果。将所有患儿分为手术组和非手术组,对超声和X线片出现的腹腔钙化、胎粪假性囊肿、肠梗阻、肠扭转、腹水和气腹等表现进行统计分析。结果:共83例新生儿(男48例,女35例)确诊为胎粪性腹膜炎,所有病例入院后均行超声及X线检查,其中61例(73.5%)需手术治疗,22例(26.5%)未手术,经对症保守治疗好转出院。手术组肠梗阻(超声24/61,放射32/61)、腹水(超声27/61)、肠扭转(超声13/61)3种影像表现出现比例均高于非手术组,差异有统计学意义($P < 0.05$),手术组气腹征象也高于非手术组,但数量较少,差异无统计学意义。手术组的弥漫性腹腔钙化、胎粪性假性囊肿占比与非手术组差异无统计学意义。结论:影像学表现中肠梗阻、腹水、肠扭转和气腹等征象高度提示需要手术治疗,仅存在腹腔多发钙化灶影像表现的新生儿可保守治疗,胎粪性假性囊肿患儿如不合并上述几种表现不需要手术治疗。

[关键词] 新生儿;胎粪性腹膜炎;超声;放射学**[中图分类号]** R722.13**[文献标志码]** A**[文章编号]** 1007-4368(2024)01-060-06**doi:** 10.7655/NYDXBNSN230679

Value of ultrasonography combined with radiology in the evaluation of treatment methods for meconium peritonitis in newborns

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[Abstract] **Objective:** To explore the value of imaging in the diagnosis of neonatal meconium peritonitis and the selection of treatment methods. **Methods:** We retrospectively analyzed the clinical, ultrasound and radiological manifestations and treatment results of 83 neonates, which were diagnosed as meconium peritonitis, from January 2018 to December 2022. The children were divided into the surgical group and the non-surgical group, and the manifestations on ultrasound and X-ray examination such as peritoneal calcification, meconium pseudocyst, intestinal obstruction, volvulus, ascites, and pneumoperitoneum were analyzed. **Results:** Eighty three neonates (48 males and 35 females) were diagnosed as meconium peritonitis in this period. All patients received ultrasound and X-ray examination after admission. Among them, 61 cases (73.5%) required surgical treatment, and 22 cases (26.5%) were successfully treated non-surgically. The occurrence rates of three imaging manifestations, including intestinal obstruction (ultrasound 24/61, radiography 32/61), ascites (ultrasound 27/61), and intestinal torsion (ultrasound 13/61), were higher in the surgical group than the non-surgical group ($P < 0.05$). The presence of pneumoperitoneum signs in the surgical group was also higher than the non-surgical group, but the number of cases was not enough to show statistical significance. There was no statistical difference in the proportion of multiple calcifications and meconium pseudocysts between two groups. **Conclusion:** Imaging findings that predicted the need for surgery were intestinal obstruction, ascites, volvulus and pneumoperitoneum. Neonates only with multiple calcifications in the peritoneum can be successfully treated non-operatively. Children with meconium pseudocyst do not need surgery if they do not have the above manifestations.

[Key words] neonate; meconium peritonitis; ultrasound; radiology

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胎粪性腹膜炎(meconium peritonitis, MP)是胎儿期宫内肠穿孔,胎粪外泄到腹膜腔引起的无菌性腹膜炎,发病率低,约1/3万,但病死率较高,后期可有钙化^[1],尽早诊治可改善预后^[2-3]。超声与放射学检查是目前MP诊断的最重要方法,二者不仅可以对MP作出准确诊断,还可以对临床的治疗方式提供准确指导^[4]。本研究回顾性分析南京医科大学附属儿童医院收治的83例MP患儿的临床表现、影像学检查和治疗结果,总结影像学特征,并对最终治疗方式进行统计分析,探讨影像学检查在选择新生儿MP治疗方式中的作用,提高影像学对于MP的诊断价值及临床指导价值。

1 对象和方法

1.1 对象

收集南京医科大学附属儿童医院2018年1月—2022年12月收治的83例MP患儿,其中,男48例,女35例,最小出生2 h,最大出生1个月,平均发病年龄约出生28 h。出生时体重2 150~4 850 g。患儿因呕吐、拒奶、腹胀等症状来院就诊。入院后均行腹部X线及超声检查,另有13例患儿行消化道造影,20例患儿行腹部CT检查。纳入标准:经临床和影像学评估诊断为MP患儿。根据最终治疗方式分为手术组与非手术组。手术组根据患儿术后最终病理结果诊断,共纳入61例,其中,男35例,女26例。非手术组由外科医生根据患儿住院期间的影像学检查、临床症状及实验室检查等作出最终诊断,共22例,其中,男13例,女9例。排除标准:①新生儿腹腔内钙化,但临床诊断不明确,如肠道结石或其他伴钙化的腹腔肿物;②未经超声和X线检查同时评估的患儿。本研究为回顾性分析研究,所有病例的临床及影像资料收集与研究均符合伦理要求(伦理批号:202305001-1),所有入组患儿监护人均知情同意。

1.2 方法

超声检查:GE Logiq E8超声仪,线性探头8~12 MHz,凸面探头1~6 MHz;Philips IU22超声仪,线性探头5~11 MHz,凸面探头5~8 MHz。患儿平卧位,从上腹部至盆腔沿肠腔走行对整个腹部进行多切面、多方位扫查,使用高频探头重点检查腹腔有无钙化、浑浊腹水、包裹性积液,有无肠管扩张及扩张程度等,当有肠梗阻时要重点观察梗阻处的肠壁结构、血供。如发现腹腔内混合包块时,观察内部回声结构、血供情况及与周围组织的关系,男性扫

查双侧阴囊是否有鞘膜积液及钙化斑,女性扫查子宫及双侧附件区。

放射学检查:腹部X线片包括仰卧位与侧卧位,采用Siemens无线移动DR机,摄片条件:45 kV/1.2 mAs,投摄范围为膈顶至耻骨联合。采用Philips Brilliance 256排螺旋CT连续容积扫描,扫描范围由膈肌至耻骨联合。

重点统计两组患者在X线片或CT或超声检查中是否有以下表现:腹腔钙化、胎粪假性囊肿、肠梗阻、肠扭转、腹水和气腹。

1.3 统计学方法

应用SPSS22.0统计学软件进行统计分析,分类计数资料采用例数(百分率)[$n(\%)$]表示。应用卡方检验或Fisher确切概率法比较不同分组间相关参数有无统计学差异。应用Spearman相关系数分析法进行相关性分析。 $P < 0.05$ 为差异有统计学意义。

2 结果

2.1 MP超声表现

超声表现:①25例肠梗阻,超声显示肠管扩张伴积液,肠腔张力增高,积液内可见强回声光点,肠管蠕动减慢(图1A、B);②56例可见腹腔内的多发点状钙化,较多时可见于整个腹腔(图1C),此为胎粪漂浮于液体中的影像表现;③31例假性囊肿,表现为腹腔内包裹性积液,与周围组织粘连,内见点片状钙化灶,伴有浑浊稠厚积液,周边呈强回声环(图1B),彩色多普勒显示其内无明显血流信号;④31例见浑浊腹水,较大前后径10~50 mm(图1B);⑤10例显示膈下游离气体;⑥13例可见肠扭转,腹腔内可见部分小肠纠集,有旋转感,可见环形彩色血流。

2.2 MP放射学表现

主要分为3种类型:①腹膜炎、气腹型,肠壁穿孔后肠管间互相粘连聚集,肠壁水肿,腹腔内见散在致密钙化影,一般不伴气液平。气腹时可见大量气体回声,伴膈下游离气体(图2A、B),其中20例为包裹性积液积气,表现为腹腔局限性囊性低密度影伴积气积液,部分见致密钙化影,呈假性囊肿征;②肠梗阻型,患儿腹壁紧张,肠淤胀,伴多发阶梯状气液平,伴散在钙化灶;③单纯钙化型,腹腔内见点状强回声,未见包裹性积液,肠管无扩张,无腹水、气腹及肠梗阻表现。20例患儿行CT检查:腹腔内多发巨大气液平,肠管扩张呈梗阻表现,肠间隙见多发点、片状钙化灶(图2B、C),10例患儿CT

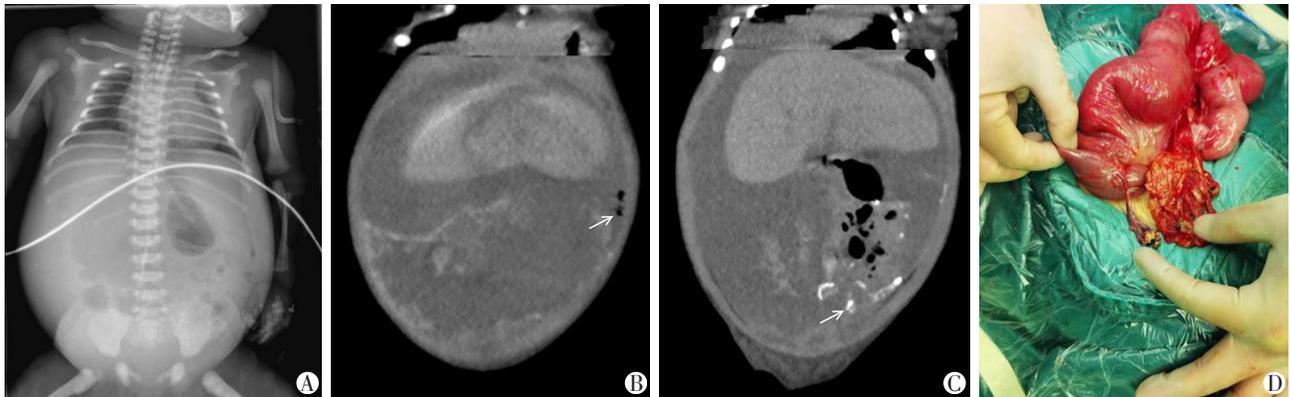
发现腹腔内囊性占位,囊内伴液平,壁见多发强光点(图2C)。



A: Abdominal ultrasound reveals wide dilation and fluid accumulation in the lower abdominal intestinal cavity, as well as thickening of the intestinal walls. B: Ultrasonography shows cystic hypoechoic areas in the abdominal cavity, characterized by multiple dense punctate echogenic calcifications and strong echogenicity of the posterior wall. There is also significant fluid accumulation in the intestinal spaces. C: Ultrasonography detects multiple irregular calcifications within the abdominal cavity.

图1 MP新生儿腹部高频超声表现

Figure 1 High-frequency ultrasound findings of meconium peritonitis (MP) in neonates



A: X-ray shows minimal gas filling in the abdominal intestinal cavity with clustering in the central abdomen (→ as shown). Suspected diagnoses are intra-abdominal fluid accumulation and pneumoperitoneum. B: CT scan reveals significant fluid accumulation with gas-fluid levels in the abdominal cavity. Gas echoes are visible in the left central abdomen (→ as shown). C: CT scan demonstrates the presence of free gas shadows in the abdominal cavity, as well as multiple calcifications in the lower left central abdomen (→ as shown). D: Intraoperative image displays collapsed and occluded intestinal segments (→ as shown). The remaining bowel loops are significantly dilated, with swelling of the intestinal wall. Adherent yellow meconium-like material is observed on the intestinal wall and peritoneum.

图2 MP新生儿腹部放射学表现及部分术中表现

Figure 2 Radiographic and intraoperative findings of meconium peritonitis (MP) in neonates

表1总结了放射学及超声的影像学表现。其中胎粪性假性囊肿、气腹、腹水的影像表现常见于超声检查,肠扭转在超声检查中诊断,而肠梗阻更常见于X线。腹腔钙化在两种检查方法中出现的次数相近,差异无统计学意义。除了腹水和肠扭转,两种检查方法的其他影像学表现均没有统计学意义上的差异。表2统计了3种检查方式对于MP诊断准确性,放射学联合超声检查准确性最高,达85.5%,3种检查方法的确诊率比较使用卡方检验,结果显示差异有统计学意义($\chi^2=8.75, P < 0.05$)。

表1 83例MP患儿的影像学表现汇总比较

Table 1 Summary and comparison of imaging findings in 83 cases of MP [n(%)]

Imaging findings	Radiological examination (n=83)	Ultrasound (n=83)	P
Peritoneal calcification	53 (63.9)	56 (67.5)	0.624
Meconium pseudocyst	20 (24.1)	31 (37.3)	0.064
Intestinal obstruction	33 (39.8)	25 (30.1)	0.193
Pneumoperitoneum	4 (4.8)	10 (12.0)	0.094
Ascites	13 (15.7)	31 (37.3)	0.002
Volvulus	0 (0)	13 (15.7)	< 0.001

表2 不同检查方法诊断准确率统计

Table 2 Statistical analysis of accuracy rates by different examination methods [n(%)]

Diagnostic results	Methods		
	Ultrasound (n=83)	Radiological examination (n=83)	Combined examination (n=83)
Confirmed	59(71.1)	55(66.3)	71(85.5)
Unconfirmed	24(28.9)	28(33.7)	12(14.5)

2.3 手术组与非手术组影像学表现的差异

表3分别总结了手术组和非手术组的超声和放射学检查表现。结果显示,超声与放射学检查中腹腔钙化、胎粪性假性囊肿、气腹在手术组与非手术组差异均无统计学意义。超声征象肠梗阻、腹水、肠扭转3种表现在手术组出现比例高于非手术组($P < 0.05$);放射学检查中肠梗阻征象在手术组中比例高于非手术组($P < 0.05$),腹水征象在手术组比例亦高于非手术组,但未达到统计学意义($P > 0.05$)。

表3 手术组与非手术组MP患儿的影像学表现汇总

Table 3 Summary of imaging findings in the surgical and non-surgical MP patients (n)

Imaging findings	Surgical (n=61)	Non-surgical (n=22)	P
Ultrasound			
Peritoneal calcification	42	14	0.654
Meconium pseudocyst	22	9	0.687
Intestinal obstruction	24	1	0.002
Pneumoperitoneum	9	1	0.207
Ascites	27	2	0.003
Volvulus	13	0	0.018
Radiological examination			
Peritoneal calcification	40	13	0.587
Meconium pseudocyst	15	5	0.861
Intestinal obstruction	32	1	< 0.001
Pneumoperitoneum	3	1	0.289
Ascites	12	1	0.094

2.4 手术及临床随访诊断结果

83例患儿中61例行手术治疗(图2D),其中4例因合并肠旋转不良等多发畸形、术后感染较重等放弃治疗,术后病理提示48例为小肠闭锁,在手术患儿中占比最高(78.7%),与既往研究结论相一致^[5]。13例伴有肠扭转,19例伴有肠坏死。22例未行手术治疗,经积极抗感染等对症治疗,临床症状及影像学表现好转出院。

3 讨论

3.1 MP影像学表现与治疗方式的关系

MP是新生儿期危重的急腹症之一,可导致腹膜炎改变,部分继发肠梗阻或肠闭锁^[6],临床分为3型:无症状型、肠梗阻型、腹膜炎型。对于不同分型,处理方式也不同(表4)。手术治疗是最主要的治疗方式,但部分轻症患儿保守治疗也可痊愈。在既往胎儿病例研究中,产前影像学表现与手术指征之间的相关性已被确定^[7-8],非手术病例为24%~38%,产前持续的肠梗阻与胎粪性假性囊肿需产后手术治疗,而仅见钙化灶可保守治疗。目前产后的MP治疗方式是基于临床表现、患儿体征及影像学检查基础上的,无症状患儿考虑保守治疗,肠梗阻仍高度提示需手术治疗,但胎粪性假性囊肿患儿如不合并其他表现可暂不行手术。本研究表明,83例新生儿中有22例经评估进行了保守治疗并好转出院,其中放射学检查(33/83)或超声(25/83)提示的肠梗阻,超声提示的腹水(31/83)和肠扭转(13/83)均与最终的手术结果高度相关。气腹征象也与手术干预相关,但数量较少,未显示明显的统计学意义。弥漫性腹腔钙化灶两组间差异无统计学意义。本组中15例患儿的弥漫性腹腔钙化是X线片上的唯一表现,其中2例在超声上合并气腹和假性囊肿,手术治疗痊愈,余13例患儿超声和X线均提示单纯的腹腔钙化,保守治疗后好转。

3.2 影像学检查方法的选择

影像学检查在MP诊断中具有较高价值^[9-10],两者之间的密切关系既往已被证实^[11]。当出现腹腔内多发点状钙化灶时可考虑MP,此为该病的特征性表现;若没有钙化,出现其他表现如肠粘连、假性囊肿、肠闭锁或狭窄、腹水、肠梗阻及膈下游离气体中的2种及以上,结合病史可考虑MP。新生儿MP的影像表现多样,变化快,早期腹腔内多发点片状钙化灶时放射学检查较敏感,当肠壁穿孔时间较长,周围网膜等包裹时形成包裹性积液、积气^[12-13],即胎粪性假性囊肿或肠粘连时超声检查更敏感。超声可直观显示肠壁的蠕动、厚度、回声和血流分布等细节,放射学对于腹腔钙化灶及肠梗阻的显示更全面^[14]。本研究显示超声联合放射学检查对MP诊断率最高,可最大程度避免漏误诊的发生,新生儿因其特殊性,肠扭转、气腹、肠梗阻、腹水等临床表现并不明显,因此影像学的阳性结果对于临床制

表4 不同类型MP的临床表现及治疗方式

Table 4 Clinical manifestation and treatments of MP with different classification

Clinical features	Asymptomatic	Intestinal obstruction		Peritonitis	
		Complete	Incomplete	Diffuse peritonitis	Localized peritonitis
Clinical presentation	None	Severe vomiting; constipation; significant abdominal distension	Minor vomiting; mild abdominal distension; normal defecation	Severe toxemia; significant abdominal distension; compromised respiration	Mild symptoms; intermittent vomiting; able to eat and pass stools
Imaging findings	Calcifications	Scattered calcifications; dilated bowel loops; step ladder gas-fluid levels; ascites; subdiaphragmatic free gas	Calcifications; minimal dilatation of bowel loops; pelvic gas; less gas-fluid levels	Multiple calcifications; multiple intestinal adhesions; subdiaphragmatic free gas	Calcifications; encapsulated pneumoperitoneum; meconium pseudocyst
Treatments	Informed of risks and close clinical follow-up	Urgent surgery	Conservative treatment	Urgent surgery	Subacute surgery or conservative treatment

定诊疗方案意义重大,同时需结合临床表现及实验室检查,对于呕吐、腹胀明显,或感染指标较高的患儿,手术治疗的效果好于单纯的对症治疗,也能避免危重并发症的发生。

3.3 不足与未来方向

本研究存在一定的不足,如样本量较少,未与产前超声相结合,且本研究为回顾性分析,较难确定影像学结果对最终是否决定手术的影响程度,但影像学检查结果的重要性不容忽视。未来可建立产前产后一体化的研究体系,增加外科医生的共同参与,提升研究的准确性。

综上,超声联合放射学检查是评估MP患儿是否需要手术的有力工具,高度提示需要手术治疗的影像表现为肠梗阻、腹水、肠扭转和气腹。患儿单纯出现弥漫性腹腔钙化或假性囊肿时,可保守治疗,但需注意结合患儿一般情况及实验室指标,避免延误病情。

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