

间歇性充气加压疗法对下肢深静脉血栓患者血液流变学的影响*

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摘要 目的:观察间歇性充气加压疗法(intermittent pneumatic compression,IPC)对下肢深静脉血栓形成(deep vein thrombosis of lower limbs,DVT)患者的治疗效果,并从血液流变学方面探讨间歇性充气加压的作用机理。方法 2003年3月-2010年9月我科收治的243例下肢深静脉血栓患者,将其中42例IPC治疗病例定为B组实验组,145例单纯药物治疗病例中选取60例定为A组对照组。观察两组患者血液流变学指标和小腿肿胀消退情况的对比。结果 两组患者全血粘度、红细胞聚集指数、红细胞电泳时间、红细胞变形性,在治疗第1天较入院时无差异,组间无差异($P>0.05$),第3天较入院时有差异($P<0.05$),组间第3天有差异($P<0.05$),两组患者下肢肿胀度均明显消退,但B组肿胀消退速度明显快于对照组($P<0.05$)。结论 间歇性充气加压治疗仪可有效改变血液流变学状态,改善血液高凝状态,有效缓解肢体肿胀症状,缩短住院时间。且不增加治疗难度,使用简单,治疗依从性好。

关键词: 下肢深静脉血栓;间歇性充气加压;血液流变学;抗凝溶栓

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Effects of Intermittent Pneumatic Compression Therapy on Hemorheology in Patients with Deep Vein Thrombosis of Lower Limbs*

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ABSTRACT Objective: To observe intermittent pneumatic compression therapeutic apparatus (IPC) in the lower limbs of deep vein thrombosis (DVT) patients, and from the therapeutic effect of hemorheology aspects discusses therapeutic effect mechanism. **Methods:** From March 2003 to September 2010, 243 patients with DVT of lower limbs in our hospital, were double-blind randomized into 2 groups. Group A (60) received drug treatment only, besides, group B (42) received drug treatment and Intermittent Pneumatic Compression (IPC). Observe two groups of the hemorrheologic indices and crus swelling of contrast. **Results:** Both groups whole blood viscosity, plasma viscosity, erythrocyte aggregation index, erythrocyte electrophoresis time, the 1st day of treatment no significant difference when compared with admission, no significant difference between groups ($P>0.05$), there are differences on admission ($P<0.05$) and group differences on the third day ($P<0.05$), two groups of patients were significantly lower limb swelling subsided, but the B group of the swelling faster than the control group ($P<0.05$). **Conclusions:** Intermittent pneumatic compression therapeutic apparatus can effectively alter hemorheology state, improve blood high pour-point state, effectively relieve body swelling symptoms, shorten the length of hospitalization. And do not increase the cure difficulty, the use of simple, treatment adherence.

Key words: Deep vein thrombosis; Intermittent pneumatic compression; Hemorheology; Anticoagulant thrombolysis

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前言

下肢深静脉血栓(DVT)是临床常见的静脉回流障碍性疾病,其引发的严重的并发症-肺栓塞(pulmonary thrombo-embolism, PTE)是临床猝死的常见原因之一^[1],近半数DVT患者最终遗留慢性血栓形成后综合征(post-thrombotic syndrome, PTS)^[2]。抗凝溶栓是DVT的基本治疗方式,DVT的各种治疗方

式均以此为基础。间歇性充气加压疗法(IPC)主要用于大手术后DVT的预防及后续康复治疗。相对于无任何预防措施的患者,IPC装置能使深静脉血栓的发生率减少约60%^[3]。基于其有效性,我科在DVT患者的治疗过程中应用该装置,取得了较好的治疗效果。

1 材料与方法

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1.1 患者资料

2003 年 3 月 -2010 年 9 月我科收治的 DVT 患者共 243 例,其中单纯传统药物治疗 145 例,入选药物组 60 例,男 28 例,女 32 例;左下肢 47 例,右下肢 13 例;年龄 25-78 岁,平均 52.3 岁,发病时间 1-30 天,平均 7.9 天,有 2 例并发 PTE。IPC 治疗 42 例,其中男 26 例,女 16 例;左下肢 36 例,右下肢 6 例;年龄 28-85 岁,平均 56.7 岁,发病时间 1-30 天,平均 9.3 天,有 5 患并发 PTE。患者均经下肢静脉彩超或下肢静脉造影确诊无误。PTE 患者均有相关影像学证据。

1.2 分组方法

入选病例诊断 DVT 明确,入选标准:原发初发的 DVT;入院前均否认使用抗凝药及非甾体类抗炎药;不存在抗凝溶栓禁忌;不合并严重并发症及精神异常;有好的治疗依从性。IPC 者 42 例为 B 组实验组,从单纯药物治疗者 125 例中选取 60 例作为 A 组对照组,对照组病例选取与实验组相比,在性别、发病年龄、发病时间、入院周径差、患肢侧别 5 个方面无差异($P>0.05$)。

表 1 两组患者入选情况比较
Table 1 Comparison of the two groups' patients selected

Group	N	Age(Years)	Diseasetime (days)	Circumference difference(cm)	Left/Right	Sex (Male/Female)
Grouop A	60	52.33± 16.93	7.88± 5.48	3.73± 1.76	47/13	28/32
Grouop B	42	56.74± 17.28	9.25± 5.59	4.07± 2.04	36/6	26/16
P value		0.203	0.223	0.361	0.439	0.121

Note: No difference between groups in selected indicators($P>0.05$)

1.3 治疗方法

两组患者基础治疗及护理均相同。A 组抗凝采用低分子肝素钙(low molecular weight heparin calium, LMWHC),溶栓药尿激酶(urokinase,UK),均为外周静脉缓慢推注。B 组 LMWH、UK 用法用量与 A 组相同,送介入室行下腔静脉滤器植入术,后行气压治疗,气压仪均采用同一型号,滤器置放术返病房后即行治疗,每天 2 次,每次 30 分,设定压力 60 mmHg。

用药期间严格检测凝血功能,调整 LMWHC 和华法令用量,抗凝强度国际标准化比值(INR)控制在 2-3^[4]之间。

1.4 检测指标

在患者入院当天,治疗的第 1、3 和 5 天清晨采集静脉血 5 ml,肝素抗凝,使用中勤世帝公司生产的 R80 型血流变测定仪,在 37℃恒温下测定高、低切变率下全血粘度(whole blood viscosity, WBV)、红细胞电泳时间(erythrocyte electrophoretic time, EET)及红细胞聚集指数(red cell assembling index, RCAI)

和红细胞变形性(red blood cell deformability, RCD),检测在标本离体 4 小时内完成。

住院期间每天检测肢体肿胀情况,测双下肢腓骨下缘以下 15 cm 处周径差,认真做好记录;记录有无出血、PTE 等并发症。

1.5 统计学处理

数据采用 SPSS13.0 软件进行统计分析,计量资料用均数±标准差($\bar{x} \pm s$)表示,计量资料比较用 t 检验,计数资料比较用卡方检验。

2 结果

2.1 两组肿胀情况比较

以周径差缩小至 2.5 cm 以下为标准,两组治疗后肿胀均明显消退,但消肿时间两组比较有差异($P<0.01$,见表 2),实验组消肿时间明显短于对照组。

表 2 周径差缩小至 2.5 cm 所需天数
Table 2 The days required when circumference difference down to 2.5cm

Group	N	Days
Group A	60	5.81± 1.76
Group B	42	3.27± 1.06
P value		<0.01

Note: Days more differences between groups($P<0.01$)

2.2 两组血液流变学指标比较

两组患者各项指标在入院当天组间无差异,治疗第 1 天较入院时无差异,组间无差异($P>0.05$),从第 3 天开始较入院时有差异($P<0.05$),组间第 3 天有差异($P<0.05$)。

2.3 并发症比较

两组患者住院期间治疗依从性好,住院期间均未检测到

PTE。已合并有 PTE 的 7 例患者未再进展。实验组 1 例治疗好转后转科死亡。部分患者出现不同程度出血倾向,包括皮肤瘀斑、牙龈出血、鼻衄、血尿、黑便等,实验组 4 例,对照组 5 例。两组比较无差异($P>0.05$)。实验组没有病例出现滤器穿刺点出血及血肿。

表 3 两组血流变学指标的比较
Table 3 Comparison of hemorrheology of the two groups

Time	Group	WBV	WBV	RCEI	EET	RCD
		Low shear rate	High shear rate			
Admission	A	14.25± 2.73	6.95± 1.87	7.56± 1.54	19.20± 5.33	1.97± 0.34
	B	14.81± 2.32	6.84± 1.82	7.48± 1.59	19.57± 5.19	1.98± 0.43
1	A	13.55± 1.97	6.42± 1.35	7.03± 1.32	18.77± 4.83	1.88± 0.31
	B	13.05± 2.01	6.04± 1.66	6.97± 1.58	18.47± 4.49	1.63± 0.52
3	A	11.53± 3.54 [△]	5.57± 1.44 [△]	5.98± 1.41 [△]	18.65± 4.16	1.22± 0.77 [△]
	B	9.14± 2.37 ^{△▲}	4.12± 1.05 ^{△▲}	4.16± 1.16 ^{△▲}	13.31± 3.32 ^{△▲}	0.78± 0.68 ^{△▲}
5	A	9.83± 2.84 [△]	4.45± 1.19 [△]	5.91± 1.34 [△]	16.04± 3.52 [△]	0.83± 1.16 [△]
	B	7.38± 2.19 ^{△▲}	4.15± 1.11 ^{△▲}	4.18± 1.26 ^{△▲}	13.18± 2.31 ^{△▲}	0.76± 1.38 [△]
7	A	8.71± 2.33 [△]	4.02± 1.04 [△]	5.59± 1.26 [△]	13.92± 3.46 [△]	0.79± 1.10 [△]
	B	6.38± 2.30 ^{△▲}	3.39± 0.95 ^{△▲}	4.16± 1.20 ^{△▲}	12.99± 3.71 [△]	0.78± 1.32 [△]

Note: △P<0.05 Compared with admission ;▲P<0.05 Group A compared with group B

3 讨论

Virchow 提出的 DVT 三大发病机制:血液淤滞、管壁损伤和血液高凝都直接或间接与血液流变学的改变有关。各种原因引起的体液稳态的明显改变,血液呈高凝状态,较正常极易受到触发而有血栓形成倾向^[5]。

血液粘度是一组复合性指标,其中红细胞压积、红细胞变形性及聚集性是其影响因素^[6]。高切变率下的血液粘度增高,说明血液中的红细胞变形能力下降,在未梢循环中的通透能力降低,使循环阻力增加,血流变慢,低切变率下的血液粘度增高,说明红细胞易聚,形成红细胞聚集体,使血粘度增加^[7]。IPC 加压时产生的机械效应是其快速消肿的基础。IPC 装置以不同压力开始从远侧气囊向近侧气囊进行顺序充气加压和放气减压,从而形成对下肢从远心端向近心端的挤压过程,血管腔内外压力改变加快血流速度^[8,9],以对抗由于血流变慢和血液粘度增加而导致的血栓形成倾向。IPC 在下肢产生的周围压力也传导到皮下组织和肌群。使组织间隙压力增加,组织静水压升高,促进组织渗出液吸收入血,加速下肢肿胀消退^[10]。

有研究发现将 IPC 用于上肢时,能降低下肢的深静脉血栓形成的发生率^[11]。这个发现提示 IPC 除了其机械加压所至的患肢血流动力学的改变外尚存在其他机制。纤维蛋白溶解活性受到组织型纤溶酶原激活物(t-PA)和纤溶酶原激活物抑制物-1 (PAI-1) 的调节,IPC 作用于患肢时,能使 PAI-1 的活性降低,tPA 的表达和活性继发性增加。IPC 通过转变两者的平衡,提高纤维蛋白溶解酶活性,使组织纤溶活性增加^[12,13],有利于血栓的溶解。IPC 机械压力增加了血管壁的剪切压,NO 在血管受到机械刺激后释放出来,产生相应的舒血管效应,改善微循环^[14]。根据以上原理,临床上 IPC 也被用于治疗下肢淋巴性水肿^[15]、各种损伤引起的淤血肿胀^[16]、胫前粘蛋白沉积症、PTS 的后期康复治疗等疾病^[17]。

本研究实验组患者患肢肿胀消退速度明显快于对照组,消退节奏与患者血液流变学指标基本同步,表明 IPC 的机械和生化效应导致的血液流变学改变是加速肿胀消退的原理所在。

IPC 产生的机械振动作用无疑增加了不稳定血栓和漂浮血栓脱落的风险^[18],有必要放置下腔静脉滤器,下腔静脉滤器能有效拦截深静脉脱落的血栓,预防 PTE^[19]。治疗过程中所有患者依从性好,使用 IPC 装置时未诉及任何不适。研究表明,IPC 能显著改善血液流变学指标,改善血液高凝状态和下肢血流动力学。加快患肢肿胀消退速度,缩短住院时间,且操作简单,治疗依从性好,值得临床进一步推广。

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