

## 医药卫生

# 彩色多普勒超声在腹壁下动脉穿支选择中的应用

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**摘要** 验证彩色多普勒超声对腹壁下动脉穿支血管术前探查的有效性,寻找腹壁下动脉穿支术前优势穿支的选择标准。利用彩色多普勒超声探查腹壁下动脉穿支皮瓣行乳房再造患者52例,重点记录穿支血管穿腹直肌前鞘点的体表投影、口径、血流信息,并通过分析比较以上信息,选择优势穿支。结果52例患者腹壁下动脉穿支穿腹直肌前鞘点于超声下均可显示,平均每侧下腹部3支,距脐平均( $5.7 \pm 2.09$ )cm,其中条件适用于显微外科的穿支平均口径( $0.95 \pm 0.32$ )cm,血流峰速平均约16.4 cm/s,阻力指数平均0.7。术中优势穿支采用率92.31%。说明高频彩色多普勒超声适用于腹壁下动脉穿支皮瓣术前血管探查,可精确指导穿支的术前选择,辅助手术方案制定以及皮瓣设计。

**关键词** 彩色多普勒超声 腹壁下动脉穿支 显微外科

**中图法分类号** R622.9; **文献标志码** A

穿支皮瓣相较传统肌皮瓣而言,由于其供区破坏损失小,受区修复重建好等显著优点,是一项概念和技术上的革新,也是国内外近年来皮瓣移植领域发展的最新方向<sup>[1-3]</sup>。其中,腹壁下动脉穿支(deep inferior epigastric perforator, DIEP)组织量充裕、皮瓣存活率较高、供区损伤较小且瘢痕隐蔽,被广泛应用于头颈部及四肢等各个部位的显微修复再造手术<sup>[4-8]</sup>;而鉴于该皮瓣与女性乳房质地及组织量相似、术中对腹直肌破坏小进而避免了术后腹壁疝以及腹壁膨隆的发生等特点,腹壁下动脉穿支皮瓣在乳房再造中正发挥日益重要的作用<sup>[9-11]</sup>。然而,由于腹壁下动脉穿支点部位、口径及数量变异均较大,加之术中追踪解剖血管蒂难度较高,术前利用影像学技术探查穿支点位置、测量其管径及走行,进而通过评估所得信息,从众多穿支中提前选出优势穿支,对手术的安全性及成功率都具有重要的意义<sup>[12]</sup>。运用高频多普勒彩超对上海交通大学医学院附属第九人民医院整形外科自2012年2月至2014年2月共52例利用腹壁下动脉穿支皮瓣进行乳房再造的患者进行了术前穿支血管超声探查,用以发现、准确定位口径在0.5 mm以上的腹壁下动脉穿支,通过测量并比较其血管直径、血流情况,从中选出优势

支,为手术操作及术中穿支选择提供准确可靠信息,探讨超声在穿支血管术前探测及选择上的应用价值。

## 1 资料和方法

### 1.1 研究对象

从2012年2月至2014年2月,在上海交通大学医学院附属第九人民医院整形外科行腹壁下动脉穿支皮瓣乳房再造术患者共52例,其中1例为烫伤后乳腺缺失胸壁疤痕粘连,2例为乳腺癌根治术即时硅胶假体隆乳术后患者,其余病例均为乳腺癌术后患者,距乳腺切除术后时间26个月~12年,除一例烫伤后患者19岁以外,其余患者年龄35~46岁,平均42岁。患者BMI为19.1~27,平均22.78。

### 1.2 仪器与方法

本文采用为迈瑞公司的M5便携笔记本式彩色多普勒超声诊断仪,使用10L4S线阵探头,探头频率8~12 MHz,速度标尺设为3.1 cm/s,选用甲状腺检查条件,将仪器调整至最敏感且不产生噪音。嘱患者取仰卧位,充分暴露剑突下至耻骨联合,首先在一侧腹股沟韧带中点向上探及该侧腹壁下动脉主干,将探头沿动脉主干向内向上自脚侧至头侧探查,过程中可探及腹壁下动脉在走行中发出的多条分支,追踪各分支,寻找其各自于腹直肌前鞘的穿出点,并标记穿出点的体表投影。同理,观察并记录对侧腹壁下动脉主干及穿支情况,并标记其体表投影点。

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探及两侧腹壁下动脉穿支情况后,记录其主干动脉及其伴行静脉口径、走行、穿腹直肌前鞘处穿支血管直径、血流情况、脂肪内走行以及分布情况等。以上每个数据分别测量3次,取平均值并记录。在位置适合皮瓣设计的穿支中,综合以上信息选择优势穿支。术中收获腹壁下动脉穿支皮瓣时,穿支的分离解剖以及选择均由同一有经验术者操作。记录术中所选用穿支、术中所见以及皮瓣存活情况,比较穿支口径、血流情况对穿支选择的影响,评判超声下穿支选择标准的有效性。

## 2 结果

本研究中52例患者双侧腹壁下动脉主干均清晰显示,其中34例追踪主干进入腹直肌后探及清晰粗大的分支及其腹直肌内走行、穿腹直肌前鞘点及其脂肪内分布;12例探及主干后无法清晰探及其分支发出部位,但分支在腹直肌内走行及其穿腹直肌点显示清晰;6例无法探及与腹壁下动脉主干发出关系明确的分支或其在腹直肌、脂肪内走行,仅于腹直肌前鞘探及穿支点,获得其穿支血管的口径以及血流情况。

在52例患者中,每例患者双侧腹部均于腹直肌前鞘成功探及腹壁下动脉穿支,每侧2~5支,平均( $3.1 \pm 0.96$ )支。其中认为设定超声下测得穿前鞘处口径 $\geq 0.5$  mm穿支为显微外科手术可用穿支,则该51例患者每侧腹部可用穿支数为0~4支,平均( $2.6 \pm 1.02$ )支。腹部两侧穿支分布基本对称。超声下探得腹壁下动脉穿支距脐平均( $5.7 \pm 2.09$ )cm,所有穿支中,口径 $\geq 0.5$  mm的可用穿支距脐平均( $5.17 \pm 1.71$ )cm。

在该52例患者共322支穿支中,可用穿支口径约( $0.95 \pm 0.32$ )cm。对可用穿支血流情况进行测量,测得血流峰速( $16.4 \pm 7.17$ )cm/s,阻力指数( $0.7 \pm 0.16$ ),其伴行静脉血流信号测得率为42%,当同时测得动、静脉血流信号时,多普勒频谱上常可观察到方向相反的动、静脉频谱(如图1),静脉血流速度平均约( $5.71 \pm 2.9$ )cm/s。

综合超声下所得腹壁下动脉穿支信息,在口径 $\geq 0.5$  mm的可用穿支中排除位置不利于皮瓣设计的穿支后,重点标记每侧口径最粗穿支1支,当两支或以上穿支口径相同时,标记其中血流峰速最高者,并将该穿支定为腹壁下动脉优势穿支。

术前超声所示穿支共322支,术中证实存在共310支。4例患者术中未采用超声下所选优势穿支,其余48例患者术中均采用超声提示下优势穿支。术后除1例采用双侧口径均小于0.5 mm的穿支

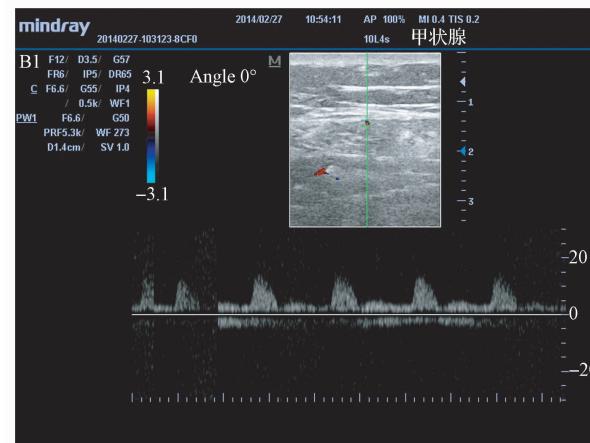


图1 测得动脉图谱血流峰速18 cm/s,阻力指数(RI)0.72,同时可及反向的伴行静脉频谱,血流速度3 cm/s

Fig. 1 The frequency spectrum of the perforator: indicating the artery's pulse stream velocity (PSV) of 18 cm/s, and resistant index (RI) of 0.72. Meanwhile, the spectrum of the vein emerges reversely with a PSV of 3 cm/s

(左侧穿支0.4 mm,右侧穿支0.2 mm)患者在术后第三天发生皮瓣部分坏死,后清创改用背阔肌皮瓣修复,其余皮瓣均存活良好。

## 3 讨论

Koshima和Soeda于1990年首次提出了穿支皮瓣及显微外科技术<sup>[13]</sup>,并于1997年推广至全球<sup>[14,15]</sup>。在过去的传统皮瓣中,手术中为保护血管蒂,血管蒂周围的肌肉常予以同时切取,供区损伤大,功能常严重受影响,显微外科技术很好地回避了这一弊端,减少供区及受区损伤、缩短手术时间、更加利于皮瓣个性化设计<sup>[1-3]</sup>。腹壁下动脉穿支(deep inferior epigastric perforator, DIEP)皮瓣手术通过对穿支血管的精细分离,避免了传统横行腹直肌(transverse rectus abdominis myocutaneous, TRAM)皮瓣造成的腹直肌损伤,进而降低了术后腹壁疝、腹壁膨隆等并发症的发病率。

然而,虽然前人通过尸体解剖研究发现腹壁下动脉穿支在空间分布上存在一定规律<sup>[16]</sup>,文献及临床操作中仍发现腹壁下动脉穿支血管解剖学个体变异非常大<sup>[16]</sup>,其与腹壁下动脉主干的关系、在肌肉内的走行、分支穿腹直肌前鞘的穿支点分布、穿支数目、以及血流情况均不恒定,因而腹壁下动脉穿支皮瓣的术前探查尤为重要。

在既往文献研究中,已得出结论认为超声是术前检测腹壁下动脉穿支的可行手段<sup>[17]</sup>。然而,对于

具体穿支的选择及其选择标准仍未见报道。本文首次设立腹壁下动脉穿支的超声下选择标准:在下腹部距脐半径为7 cm 范围内探查口径大于0.5 mm 的穿支血管,将穿支口径选定为首要选择因素,其次为血流峰速。通过该选择标准,成功指导完成腹壁下动脉穿支(deep inferior epigastric perforator,DIEP)皮瓣修复乳房及胸壁缺损47例。

通过验证及分析,作者认为除既往文献所报道超声在DIEP手术中的应用价值,如协助手术设计,制定个体化手术方案,指导手术中血管蒂的解剖与分离,术后随访观察皮瓣血供充盈情况等<sup>[17]</sup>之外,更可进一步制定出穿支的术前选择方案。目前虽也可通过其他影像学手段如CT血管造影技术(CTA)、磁共振血管造影技术(magnetic resonance angiography,MRA)等于术前对血管进行解剖学研究,但对细小的腹壁下动脉穿支的观察能力仍有局限,且无法完成穿支口径、血流情况的数据测量及分析,同时不便于标记穿支点的体表投影,指导术中皮瓣的获取及穿支的分离。

## 4 结论

高频彩色多普勒超声可于腹壁下动脉穿支(deep inferior epigastric perforator,DIEP)皮瓣术前良好观察、评估穿支血管情况,并且通过分析比较其血管、血流相关参数,建立可行的腹壁下动脉穿支选择标准,辅助手术方案制定以及皮瓣设计。

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## “Thin-scattered-weak” Offshore Oil Field Accurate Description and Effective Development

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**[Abstract]** Due to thin oil reservoir layers, small sand bodies, scattered distribution and weak natural energy, most of the “thin-scattered-weak” offshore oil fields are difficult to develop economically and effectively. Based on well seismic integrating with rhythmic segmentation contrast technology the isochronous stratigraphic framework were established, through reservoir sedimentology research the genetic types of sandbodies were determined, by applying prestack joint inversion of P-wave and S-wave, quantitative knowledge base and geostatistics method the spatial distribution of reservoir and utilizing phase constraint of three digital geological modeling technology to carry on the quantitative characterization were described. On the basis of reservoir fine description, the formation water dumping injection and multi-underground and multi-branch horizontal wells technology were proposed and practiced. Practice shows that compared with the directional well of depletion development, single well daily production can improve the 11 times, recovery efficiency can be increased by 20%, improved development effect dramatically, which provides a new effective way to economically and effectively develop the “thin-scattered-weak” oil reservoirs on offshore and similar difficult producing reserves.

**[Key words]** offshore oil field    thin-scattered-weak oil reservoir    reservoir evaluation    formation water dumping injection    multi-underground and multi-branch horizontal wells

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## The Role of Ultrasonography in Deep Inferior Epigastric Perforator Investigation and Selection

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**[Abstract]** The purpose of the study is to prove the effectiveness of ultrasonography in deep inferior epigastric perforator (DIEP) investigation, and to look for a criteria for choosing the preferable perforator. 52 cases of breast reconstruction were used DIEP underwent preoperative ultrasound inspection. The location where the perforators penetrate the anterior rectus sheath, and the caliber as well as the blood flow information were recorded and then analyzed, to determine the preferable perforator for surgery. Results the perforator display rate was 100% in all 52 cases, with 3 vessels on each side of the lower abdomen in average. These perforators emerged at the range ( $5.7 \pm 2.09$ ) cm radius below navel. The calibers of perforators suitable for microsurgery were ( $0.95 \pm 0.32$ ) cm on average, with a pulse stream velocity (PSV) of 16.4 cm/s and resistant index (RI) of 0.7. The rate which the ultrasonic preferable perforator adopted by the surgeon was 92.31%. Ultrasonography is applicable in perforator preop-investigation, and will play an important role in preferable perforator selection.

**[Key words]** ultrasonography    deep inferior epigastric perforator    microsurgery