

# 创伤后应激障碍患者情绪记忆优势研究述评

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**摘要** 创伤后应激障碍(PTSD)是由高情绪刺激引起延迟出现和长期持续的精神障碍。闯入、闪回、病理性重复体验、持续性警觉性增高和回避等症状严重损害其认知功能。PTSD 患者记忆形成了情绪网络。情绪记忆具有强烈、持久的特点,在记忆中具有优势地位。回顾 PTSD 患者情绪记忆优势的行为及脑成像研究发现,PTSD 患者情绪记忆优势研究结果并不完全一致,受到诸多因素的影响,这些影响因素需进一步探讨。

**关键词** 创伤后应激障碍; 记忆; 情绪记忆; 记忆优势

**分类号** R395

## 1 PTSD 与情绪记忆优势

创伤后应激障碍(Posttraumatic Stress Disorder, 简称 PTSD)是指由异常威胁性或灾难性心理创伤导致延迟出现和长期持续的精神障碍。其特征性的症状为:病理性重现创伤体验、持续性警觉性增高、持续性回避、对创伤性经历的选择性遗忘以及对未来失去信心等(American Psychiatric Association, APA, 2000)。中国精神障碍诊断与分类标准第三版(CCMD-3) 2001 年首次使用这一名称(Chinese Society of Psychiatry, 2001),并把它纳入反应性精神障碍以替换 CCMD-2R 的延迟性应激障碍。随着战争、社会暴力、重大交通事故及自然灾害等意外事故的增多,PTSD 的出现也越来越多,而因发病率高、病程长及疗效差等特点严重影响创伤救治而备受关注(Kessler, 2000)。

PTSD 的中心病征是创伤重复体验征候群(McFarlane, Yehunda, & Clark, 2002),其记忆包含较多知觉特征——“旁观者体验”(McIsaac & Eich, 2004)。大量研究表明 PTSD 患者存在记忆功能性受损(e.g. Bremner et al., 1993; Francati, Vermetten, & Bremner, 2007; Gilbertson, Gurvits, Lasko, Orr, & Pitman, 2001; Rauch, Shin, & Phelps, 2006; Vasterling et al., 2002),且与创伤性事件是否相关

无关(Dickie, Brunet, Akerib, & Armony, 2008),但记忆损伤情况受到症状严重程度、创伤暴露时间、患病时间等变量的调节(e.g. Dickie et al., 2008; Rauch et al., 2006)。脑成像研究发现,PTSD 患者在额-颞皮层存在机能性损伤,包括内侧前额叶、前扣带回、额眶皮层、杏仁核、海马及海马后部等脑区(e.g. Bremner et al., 1999a; Bremner et al., 1999b; Britton, Phan, Taylor, Fig, & Liberzon, 2005; Lanius et al., 2001; Liberzon et al., 1999; Rauch et al., 2006; Shin et al., 2004b)。上述脑区均与情绪信息的加工有关,表明情绪对 PTSD 患者记忆存在直接影响。其中,备受关注的影晌是情绪在记忆中占据优势地位(e.g. Christianson, 1992; Dolan, 2002; LaBar & Cabeza, 2006)。

Kleinsmith 和 Kaplan (1963)首次报告了情绪在记忆中的优势地位,即与中性信息相比,情绪信息存在记忆增强效应。该效应已得到大量的研究支持(e.g. Bechara et al., 1995; Cahill et al., 1996; Cahill, Babinsky, Markowitsch, & McGaugh, 1995; Davidson, Maxwell, & Shackman, 2004; Dolan, 2002; LaBar et al., 2006)。然而,情绪记忆往往持久而强烈,消极的经历久久难以忘却易形成心理障碍,例如 PTSD (Dolan, 2002)。Foa, Riggs 和 Gershuny (1995)认为,PTSD 患者经历创伤事件之后,记忆形成了恐惧网络。该网络由创伤事件刺激信息、个体认知、行为和生理方面的反应信息、刺激与反应联系信息组成。情绪刺激(创伤的遗留

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物)能激活恐惧网络,使网络中的信息进入意识,个体不断重复性体验创伤经历,既会表现出对情绪刺激的持续警觉性增高,又会表现出持续性回避症状(APA, 1994)。本文中情绪记忆仅指 PTSD 患者对情绪信息的学习记忆过程,如恐惧性条件反射(e.g. Delgado, Olsson, & Phelps, 2006; LaBar et al., 2006)和对情绪信息(如恐惧或愉快面孔、场景、语词和气味等)的编码、存储和提取过程(Hamann, 2001)。而情绪记忆优势指与中性信息相比,情绪信息的记忆增强效应。大量行为及脑成像研究对 PTSD 情绪记忆优势进行了探讨,这些研究为深入理解 PTSD 症状及其成因拓宽了思路。

## 2 PTSD 情绪记忆优势的行为研究

PTSD 患者情绪记忆优势行为研究方面,自由回忆及再认测试两类范式最为常用(Brewin, 2011; Brewin, Kleiner, Vasterling, & Field, 2007)。然而,无论采用自由回忆还是再认范式,PTSD 患者情绪记忆优势的研究结果却并不完全一致。大部分研究发现 PTSD 患者对情绪刺激的记忆成绩好于中性刺激(e.g. Brewin, 2011; Dolan, 2002; Michael, Ehlers, & Halligan, 2005; Moradi, Taghavi, Neshat-Doost, Yule, & Dalgleish, 2000; Paunovic, Lundh, & Öst, 2002; Tapia, Clarys, El Hage, Belzung, & Isingrini, 2007; Thomaes et al., 2009)。Thomaes 等(2009)给 PTSD 患者及控制组被试呈现一系列负性和中性词语。结果发现,相比中性词语,PTSD 患者能自由回忆及再认更多的负性词语,而控制组被试对两类词语的记忆成绩无显著区别。Moradi 等(2000)对儿童及青少年 PTSD 患者的研究也发现了类似的结果,PTSD 患者对负性语词记忆成绩更好,特别当负性词语与被试关系更为密切时,其记忆成绩更好。综上研究表明 PTSD 患者存在情绪记忆优势。

然而,少量研究并未证实 PTSD 患者情绪记忆优势现象(e.g. Bremner et al., 2003; Dickie et al., 2008)。Bremner 等(2003)给 PTSD 患者及控制组被试呈现一系列负性和中性词语,呈现完后立即进行自由回忆测试,结果发现 PTSD 患者两类词语的记忆成绩之间并不存在显著差异。Wenzel, Adams 和 Goyette (2006)重复了此实验也发现了类似的结果,同时还发现,当对被试进行延迟自由回忆测试(如:间隔一周测试)时,PTSD 患者对

情绪刺激的记忆成绩远远高于中性刺激。表明 PTSD 患者情绪记忆优势可能需要经历记忆巩固的过程(Diener, Flor, & Wessa, 2010; Dolcos, LaBar, & Cabeza, 2004)。McIsaac 等(2004)则进一步指出,PTSD 患者对情绪刺激具有更好的记忆巩固可能与其闯入、重复性情绪体验、闪回等临床症状有关。

Dickie 等(2008)采用再认范式(Old/New 范式)同样证实 PTSD 患者情绪记忆优势可能需要记忆巩固的过程。Kuriyama, Soshi, Fujii 和 Kim (2011)最新一篇研究同时对 PTSD 患者的情绪项目和事件项目进行了立即再认和延迟再认两种测试。结果发现:在立即再认条件下,两类项目记忆成绩差异不显著;而在延迟再认条件下,情绪项目的记忆成绩好于事件项目。Sharot 和 Phelps (2004)采用 R/K 范式(Brown & Aggleton, 2001)进一步研究发现,PTSD 患者情绪记忆优势不仅与记忆巩固过程有关,可能还与其记忆自信度水平有关。PTSD 患者对于情绪和中性刺激在整体记忆水平上并不存在显著性差异,但在“记得”和“知道”两类项目上,记忆成绩出现了分离。Tapia 等(2007)也发现了类似的结果:对于“记得”的项目,PTSD 患者记忆成绩好于控制组被试;而对于“知道”的项目,两组被试成绩无显著差异,即记忆自信度调节 PTSD 患者情绪记忆优势。

相比 PTSD 患者外显情绪记忆优势的研究,PTSD 患者内隐情绪记忆优势的研究相对较少,且研究结果并不完全一致(Amir, Bower, Briks, & Freshman, 2003; Amir, Leiner, & Bomyea, 2010; Amir, McNally, & Wiegartz, 1996; Golier, Yehuda, Lupien, & Harvey, 2003; McNally & Amir, 1996)。如 Amir 等(1996, 2003, 2010)研究发现,相比中性图片,PTSD 患者对于负性及与创伤相关的图片内隐记忆成绩更好,控制组被试则未表现出类似的内隐记忆偏向。McNally 和 Amir (1996)采用类似的研究却并没有发现 PTSD 患者内隐情绪记忆优势。Golier 等(2003)采用词语刺激同时测量了被试的外显记忆和内隐记忆。结果发现 PTSD 患者外显记忆存在情绪记忆优势,而内隐记忆则不存在情绪记忆优势。研究者认为上述研究结果的不一致可能与被试(如被试的症状严重程度、症状类型)、测量材料(图片刺激和词语刺激)、测量方式等因素有关(Amir et al., 2010; Brewin, 2011)。

### 3 PTSD 情绪记忆优势的脑成像研究

行为研究结果表明 PTSD 患者情绪记忆优势可能受到被试症状严重程度、实验材料、测试方式等因素的影响。脑成像研究则从神经机制角度进一步提示 PTSD 患者情绪记忆优势可能与杏仁核、海马、内侧颞叶及前额叶等激活有关。大量研究表明,上述脑区参与情绪信息的加工(e.g. Bechara et al., 1995; Cahill et al., 1995, 1996; Dolan, 2002; Hamann, 2001; LaBar et al., 2006)。杏仁核位于海马的前方和海马旁回的深部,侧脑室下角的前方。它与内侧颞叶、前额叶皮层、前扣带回、丘脑和下丘脑等许多脑区有着广泛的纤维联系,这表明情绪记忆优势可能源于杏仁核与内侧颞叶及前额叶等的相互作用(Aggleton, 2000)。并且情绪记忆加工受到杏仁核、杏仁核和海马之间交互作用的调节(e.g. Dolcos, LaBar, & Cabeza, 2005; McGaugh, Cahill, & Roozendaal, 1996; McGaugh, McIntyre, & Power, 2002; Richardson, Strange, & Dolan, 2004; Tsoory, Vouimba, Akirav, Kavushansky, & Richter-Levin, 2008), 海马和杏仁核对情绪记忆加工具有十分重要的作用。

研究发现, PTSD 患者回忆创伤相关或情绪信息时,杏仁核的激活增强,且随着 PTSD 症状严重程度的增加而增强(e.g. Armony, Corbo, Clement, & Brunet, 2005; Geuze, Vermetten, Ruf, de Kloet, & Westenberg, 2008; Protopopescu et al., 2005; Shin et al., 2004b)。Sergegie, Lepage 和 Armony (2006) 给 PTSD 患者呈现若干恐惧表情面孔,同时测量其杏仁核激活情况。结果发现, PTSD 患者症状严重程度与其杏仁核的激活呈显著正相关关系,即症状越严重的被试其杏仁核激活越强,且无论是在编码或提取阶段。Dickie 等(2008)进一步研究发现, PTSD 患者杏仁核的激活与恐惧面孔的记忆成绩呈显著正相关关系,而与中性面孔的记忆成绩不存在显著相关关系。Armony 等(2005)发现, PTSD 患者杏仁核激活不仅仅与其记忆过程有关,可能还与更广泛的其他认知活动有关。研究者采用 DM (Different Memory, DM) 范式(Paller & Wagner, 2002)发现对于记住的和忘记的情绪项目,其杏仁核激活强度受患者症状严重程度的调节。症状严重的被试,其记住的项目诱发的杏仁核激活显著大于忘记的项目;而症状较轻或正常被试,二类项目的激活之间不存在显著差异(Rauch et al.,

2006; Shin et al., 2005)。

情绪记忆的加工不仅受到杏仁核的影响,且还受到杏仁核-海马间交互作用的调节(Sharot & Phelps, 2004; Richardson et al., 2004)。例如,一些研究发现 PTSD 患者加工情绪记忆时,海马激活降低(Astur et al., 2006; Bremner et al., 1999a, 1999b, 2003),而另外一些研究则得到相反的结果(e.g. Shin et al., 2001, 2004b; Semple et al., 2000; Thomaes et al., 2009),这一差异可能与任务类型、任务难度及数据分析方法有关(Shin & Liberzon, 2010)。Admon 等(2009)认为,杏仁核的激活可能更多的与症状严重程度有关,但症状严重程度却依赖于海马对于压力、紧张、焦虑等事件的塑造程度,所以对 PTSD 患者情绪记忆进行研究时,应同时考虑杏仁核和海马二者的作用。

### 4 评述及展望

近年来,大量行为及脑成像研究均证实 PTSD 患者存在情绪记忆优势(e.g. Brewin, 2011; Dolan, 2002; Michael et al., 2005; Moradi et al., 2000; Paunovic et al., 2002; Tapia et al., 2007; Thomaes et al., 2009),且该优势与杏仁核、海马、内侧颞叶及前额叶等激活有关(e.g. Dolcos et al., 2005; McGaugh et al., 1996; McGaugh et al., 2002; Richardson et al., 2004; Tsoory et al., 2008),而其背后的神经机制有何特点?对此,Hamann (2001)提出了情绪记忆优势的两阶段模型:编码阶段和后编码(巩固)阶段。前者主要指编码阶段对情绪刺激的注意增加和精细加工,后者主要指巩固阶段释放激素和记忆痕迹的巩固增强。杏仁核是两阶段调节的核心,两阶段可能相互作用,导致情绪刺激在编码和巩固阶段均得到不同程度的增强。

在编码阶段,情绪刺激影响注意资源的分配,通过增强注意影响记忆的有效性。从注意产生的方向来分,注意包括自下而上(bottom-up)和自上而下(top-down)两种(Corbetta & Shulman, 2002)。情绪刺激一方面具有自动加工的特性(Kensinger & Corkin, 2004),引起机体产生注意偏向,使得机体对其进行持续加工,即产生自下而上的效应(bottom-up)。情绪刺激的这种注意优先性使其产生记忆增强效应。另一方面,在编码阶段,人们对于情绪性刺激会采用相对于中性刺激更多地精细加工,如可能会倾向于将情绪性内容与额外的信

息或自身的经历、体验联系起来。通过自上而下作用的效应(top-down), 可以使得情绪性信息具有相对于中性信息更为丰富的表象特征, 使得情绪刺激产生记忆增强效应。

除此之外, 情绪还可以通过记忆巩固过程发挥其增强效应(Sharot & Yonelinas, 2008), 即情绪对记忆的调节假说(memory modulation hypothesis)(McGaugh, 2000, 2004; McGaugh et al., 1996)。该假说认为, 与中性刺激相比, 情绪刺激引起机体的应激激素(stress hormones), 即肾上腺素和糖皮质激素释放增多, 从而引起杏仁核的活动增强。由于杏仁核和记忆相关的脑区(如 MTL、PFC)有往返的纤维联系, 杏仁核的活动增强会促进这些脑区的记忆巩固过程(Koenigs & Grafman, 2009)。即虽然杏仁核在恐惧性条件反射中起着关键作用, 但对于其他的情绪信息, 其作用主要是对一般记忆过程的巩固阶段进行调节(Dolcos et al., 2004; McIsaac et al., 2004)。这一假说也得到了神经化学和脑损伤等方面的证据支持(e.g. Anderson, Wais, & Gabrieli, 2006; LaLumiere, Buen, & McGaugh, 2003; McGaugh, 2004)。

虽然大量行为研究证实 PTSD 患者存在情绪记忆优势, 然而少量研究却得出相反的结论(e.g. Bremner et al., 2003; Dickie et al., 2008)。脑成像研究发现 PTSD 患者情绪记忆优势与杏仁核、海马、内侧颞叶及前额叶等激活有关(e.g. Dolcos et al., 2005; McGaugh et al., 1996; McGaugh et al., 2002; Richardson et al., 2004; Tsoory et al., 2008), 但其激活变化同样并不完全一致(e.g. Astur et al., 2006; Bremner et al., 1999a, 199b, 2003; Shin et al., 2001, 2004b; Thomaes et al., 2009)。综上表明, PTSD 患者情绪记忆优势研究结果并不完全一致, 其原因可能与以下诸因素有关。

1) 刺激材料: 证实 PTSD 患者情绪记忆优势的研究多采用情绪图片刺激(e.g. Amir et al., 2010; Sergerie et al., 2006), 而结论相反的研究则多采用情绪词语刺激(e.g. Dickie et al., 2008; Wenzel, Jostad, Brendle, Feraro, & Lystad, 2004)。研究表明, 两类刺激诱发的情绪体验强度存在差别(Brewin et al., 2007)。

2) 研究对象: 大量研究发现, PTSD 患者症状严重程度对其认知能力具有显著的影响(e.g. Armony et al. 2005; Protopopescu et al., 2005; Shin

et al., 2004a), PTSD 患者情绪记忆优势研究结果不一致可能源于被试样本症状严重程度的差异(e.g. Brewin, 2011; Dickie et al., 2008; Zoeller, Foa, Brigidi, & Przeworski, 2000)。此外, 不同的 PTSD 患者由不同的创伤事件致病, 而创伤事件的类型对 PTSD 患者情绪记忆优势是否具有影响作用有待进一步研究。

3) 研究范式: PTSD 患者情绪记忆优势的研究存在诸多的研究范式, 如再认范式(Dickie et al., 2008)、R/K 范式(Tapia et al., 2007)、内隐记忆范式(Amir et al., 1996, 2003, 2010)、DM 范式(Paller et al., 2002)、相继记忆范式(subsequent memory paradigm)(Kensinger & Corkin, 2004)、线索记忆范式(contextual memory paradigm)(Fenker, Schott, Richardson-Klavehn, Heinzev, & Düzel, 2005; Flor & Wessa, 2010; Maratos & Rugg, 2001)、DRM 范式(Deese-Roediger-McDermott, DRM)(e.g. Deese, 1959; Roediger & McDermott, 1995; Wenzel et al., 2004)等。然而, 不同范式的研究效度存在差别。如 R/K 范式比传统再认范式(Old/New)研究 PTSD 患者情绪记忆优势更加有效。相比传统再认测试, R/K 范式不但可以考查被试的记忆正确率, 还可以同时考查被试对其判断的自信度水平(e.g. Sharot et al., 2004; Tapia et al., 2007)。

4) 记忆阶段: 证实 PTSD 患者情绪记忆优势的研究多采用了延迟测试(e.g. Kuriyama et al., 2011; Wenzel et al., 2006), 而结论相反的研究则多采用即时测试(e.g. Bremner et al., 2003; Dickie et al., 2008)。这与 Hamann 提出的情绪记忆优势两阶段模型(编码和巩固阶段)并不相符合, 该模型认为: 在编码阶段, 情绪刺激影响注意资源的分配, 通过增强注意影响记忆的有效性; 在巩固阶段, 情绪刺激引起机体的应激激素(肾上腺素和糖皮质激素)释放增多, 从而引起杏仁核的活动增强。由于杏仁核和记忆相关的脑区有往返的纤维联系, 杏仁核的活动增强会促进这些脑区的记忆巩固过程(Koenigs & Grafman, 2009)。情绪刺激在编码和巩固阶段均可得到不同程度的增强, 即无论即时或延迟测试, 情绪刺激均能表现出记忆优势。然而, PTSD 患者情绪记忆优势仅仅表现在巩固阶段而非编码阶段(Diener et al., 2010; Dolcos et al., 2004), 有研究者认为这可能与 PTSD 患者的闯入、闪回、重复情绪体验等临床症状有关

(McIsaac et al., 2004)。但此观点无法解释 PTSD 患者情绪刺激在编码阶段不存在记忆优势的现象。笔者认为此现象可能与 PTSD 患者对情绪刺激的注意偏向有关。大量研究已证实 PTSD 患者对情绪刺激存在高回避性(e.g. Bryant & Harvey, 1996; Foa & Street, 2001; McNally & Foa, 1986; Paunovic et al., 2002; Sharot et al., 2004), 在编码阶段, PTSD 患者对情绪刺激的加工精细程度可能会降低, 进而导致其记忆优势的消失, 以后的研究可同时测量 PTSD 患者对情绪刺激的注意及记忆偏向以证实此观点。

此外, 研究方法和研究内容上也存在几点局限。第一, 目前研究方法中, 行为研究依然占据主导地位, 脑成像研究相对较少。研究主要集中在编码和巩固阶段, 缺乏对提取阶段神经机制的揭示。第二, 研究内容上, 多为负性情绪刺激, 而较少关注正性情绪刺激, 仅有少量研究对 PTSD 患者正性情绪记忆进行了研究(Jatzko, Schmitt, Demirakca, Weimer, & Braus, 2006)。第三, 研究结果的解释仅仅局限于记忆领域, 忽略了其他认知能力对 PTSD 患者的影响。第四, 未能区分创伤事件的类型, 未明确不同类型创伤事件 PTSD 患者的情绪记忆是否完全相同。第五, 尽管脑成像研究加深了对 PTSD 患者情绪记忆神经机制的认识, 但目前仍存在一些值得深入研究的问题。例如, PTSD 患者情绪记忆加工时, 相关脑区激活与正常被试存在差异。但这仅仅反映了功能上的差异, 其结构是否同样存在差别, 则需要神经解剖学等方面的证据, 此方面的研究也将为 PTSD 患者的干预与治疗提供有力的支持。

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## Emotional Memory Advantage of Individuals with Posttraumatic Stress Disorder

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**Abstract:** Posttraumatic Stress Disorder (PTSD) is a chronic mental disorder caused by highly emotional events. The symptoms of PTSD, such as intrusion, flashback, pathological re-experience, increased vigilance and avoidance have severe impact on patients' cognitive functions. The memories of the PTSD patients are characterized by intense and long lasting emotional contents, which are highly salient in the system of memory. The present article reviewed the psychophysics and the brain imaging studies on the advantage of emotional memories of individuals with PTSD. Results of these studies were not consistent due to many methodological factors and further studies are needed to explore these issues.

**Key words:** Posttraumatic Stress Disorder; memory; emotional memory; memory advantage