

DEBATE

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Is acupuncture “stimulation” a misnomer? A case for using the term “blockade”

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Abstract

Background: The term used most frequently in the literature to describe acupuncture’s effects is “stimulation” which may be used to describe either (or both) the direct stimulus applied to a needle as well as putative stimulation of the nervous system, despite little published evidence describing what is actually being stimulated. In contrast, recent published work has suggested that acupuncture may, in fact be inhibitory at a peripheral level, acting by blocking neural transmission.

Discussion: The suggestion that acupuncture exerts its effects through peripheral neural blockade is supported by recent evidence explaining related techniques including low level laser and capsaicin at acupoints. It also explains acupuncture’s effect on painful and non-painful conditions and both Eastern and Western concepts of acupuncture. There is a need for additional work to elucidate acupuncture’s mechanism of action, and the suggestion that it acts through neural blockade should prompt further research in this direction.

Summary: If the term “blockade” were applied to acupuncture, this would, likely, be expected to promote this minimally invasive technique, and, potentially, bring it into mainstream clinical practice for pain management as well as other therapeutic applications.

Keywords: Acupuncture, Neural blockade, Capsaicin, Low level laser therapy, Alpha-2 adrenoceptor

Background

While the exact mechanism by which acupuncture exerts its clinical effect remains unclear, the description used for elicitation of this effect is widely termed “stimulation”. Indeed, a National Library of Medicine (PubMed) search for “acupuncture” conducted by the author on December 31, 2012 identified 18,549 articles, of which 3,334 (18%) incorporated the term “stimulation”. In contrast, only 372 (2%) incorporated the term “inhibition” and a mere 57 (0.3%) included the term “blockade”. This terminology appears to be based upon acupuncture’s historical association with Traditional Chinese Medicine, which deems that this technique stimulates acupoints along meridians to restore their function through the regulation of yin, yang and qi [1]. Acupuncture has certainly been shown to stimulate the production of a wide variety of humoral mediators, including opiates [2], monoamines [3], corticoids [4] and purines [5] by the nervous system. While it is unclear as to what proportion of these 3,334 articles used the term

“stimulation” to mean direct stimulus (manual or electrical) applied to a needle, as opposed to putative stimulation of the nervous system, the use of this term is widespread, and its ongoing use merits further consideration and clarification.

Indeed, there is recent evidence that acupuncture, and, especially, related therapeutic modalities such as low level laser therapy and capsaicin plaster – both at acupuncture points – exert their effects through neural blockade. Indeed, both laser and capsaicin appear to act at the skin level through an inhibitory mechanism. Low level laser – when applied to acupuncture points – appears to exert equivalent effects to needle acupuncture [6], and has been shown to be a highly effective therapeutic technique for pain [7]. Yet, rather than being stimulatory, Chow et al. have found that laser actually inhibits peripheral nerves [8]. Similarly, the application of capsaicin to acupuncture points in both upper [9] and lower [10] limbs results in identical effects to needle acupuncture, yet capsaicin induces neural conduction blockade rather than stimulation [11]. It is, of course, quite possible, that acupuncture employing needle insertion induces its clinical effect through an entirely

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different mechanism to that of laser acupuncture and capsaicin application to acupuncture points. Nonetheless, is it not worth considering whether the therapeutic mechanism of these three techniques might be identical or comparable?

Zunhammer et al. have recently demonstrated that verum – but not sham – needle acupuncture inhibits motor excitability [12]. How would “stimulation” inhibit muscle tone? If acupuncture were stimulatory at the periphery, would a second “stimulation” not be expected to increase brain activity? Yet, Yeo et al. found that consecutive needle acupuncture treatments at the same point resulted in reduced functional MRI brain activation following the second treatment 5 minutes after the first [13]. Neuropeptide Y is released by the hypothalamus in response to, and is a marker of, physical or metabolic stress [14], yet Eshkevari et al. have recently demonstrated that needle acupuncture blocks this response [15], and there is also recent evidence suggesting that acupuncture blocks the expression of transient receptor potential neuronal ion channels [16].

Could a case be made for replacing the term “acupuncture stimulation” with the term “acupuncture blockade”?

Discussion

The mechanism by which acupuncture exerts its clinical effect remains unclear, but the term “stimulation” remains in wide clinical use [1]. If acupuncture is stimulatory, what is actually being stimulated? The term “stimulation” in acupuncture may be used to describe either (or both) the direct stimulus applied to the needle (for needle acupuncture), as well as putative stimulation of the nervous system that is assumed to derive from the applied mechanical or electrical needle stimulation. While there is certainly evidence indicating that some forms of acupuncture result in stimulation of endogenous mediators, especially opiate production following electroacupuncture [2], the eminent Chinese acupuncture researcher, Professor JS Han, wrote in 2004 (in relation to the stimulation of endorphin release), “The findings obtained from experimental animals need to be confirmed in humans in clinical practice [2].” Opioid release continues to be shown to be involved in the mechanism of electroacupuncture analgesia in experimental animals, most recently by Meng et al. in 2011 [17], but has yet to be confirmed as being involved in humans, while only a solitary published study exists in support of laser acupuncture causing endogenous opioid release, that study utilizing power outputs substantially far greater than those used in clinical practice [18].

If acupuncture works by blocking – rather than stimulating – nerves, in addition or an alternative to endogenous mediator release, where does this occur, and is this blockade a peripheral or central effect? Using functional brain imaging, Hsieh et al. demonstrated an increase in periaqueductal gray cerebral activation following painful

stimulation [19], while Zyloney et al. later showed that acupuncture at verum – but not sham – points blocked periaqueductal gray activation [20]. Hence, acupuncture may well block the brain activation induced by a painful event, but is this central blockade “direct” or “secondary”? Any primary afferent nerve stimulation can potentially elicit a complex pattern of secondary CNS responses, some excitatory and some inhibitory [21], but is there a unifying peripheral mechanism by which application of a needle, laser or capsaicin plaster might cause an inhibitory response?

Low level laser appears to block peripheral nerves by suppressing neural action potentials through induction of mitochondrial dysfunction and the disruption of microtubule arrays and fast axonal flow [8], while capsaicin results in vanilloid receptor desensitization, also blocking peripheral nerves [11]. How might needle or electroacupuncture block peripheral nerves? One possible explanation previously suggested by the author is that acupoints are the branch sites of unmyelinated cutaneous afferents, and that acupuncture disrupts this point, blocking both centripetal sensory transmission to the spinal cord and tangential communication along sites of peripheral afferent cross-talk [22]. Preliminary evidence in support of this theory has since been found in histologic analysis of human acupuncture points [23]. Langevin and colleagues have shown that the fascia surrounding a needle inserted at an acupuncture point “grasps” the needle, and suggested that there is winding and stretching of the fascia around the needle as it is rotated [24]. There are recently-discovered stretch-activated transient receptor potential (TRP) ion channels on nociceptive axons [25], and their stretching during needle acupuncture may well cause desensitization and blockade, in a manner similar to capsaicin at vanilloid TRP channels. Similarly, electrical stimulation of C-fibers, as might occur in electroacupuncture, results in prolonged conduction blockade [26].

If acupuncture were to act primarily by stimulating release of endogenous opiates or other mediators, then point selection should be irrelevant. Langevin and colleagues have demonstrated that over 80% of acupuncture points are located along connective tissue cleavage planes [27], and, subsequently, fMRI studies have shown that acupuncture at known acupoints results in a very different response to acupuncture at non-acupoint sites [28-30]. If point selection is relevant to the mechanism of acupuncture’s effect, this would be at odds with the suggestion that it works by stimulating endogenous opiate or other mediator release.

This might indicate that precise acupuncture point localization prior to needle insertion could be critical for eliciting a specific response, yet there is evidence of considerable imprecision in needle placement [31], and Habib [32] has recently suggested that this imprecision may account for the variability in the results of acupuncture trials. For acupuncture to work by directly disrupting – and

thus blocking – nerves emerging at connective tissue cleavage planes, there would need to be considerable accuracy in point localization.

The proposal that acupuncture blocks nerves at a peripheral level would uniquely explain three major issues which have previously not been well understood:

The multitude of modalities used in clinical acupuncture

As noted above, acupuncture treatment is not strictly limited to needle insertion, with many practitioners employing other techniques, including moxibustion [1], low level laser [6], capsaicin plaster [9], and even simple manual acupoint massage (acupressure) [33].

Yet, all of these techniques are centered upon treating specific acupoints, and in common with needle acupuncture, can be understood if considered to block neural conduction peripherally [8,11,22].

Acupuncture's range of clinical effects

In addition to its use in treating pain, acupuncture has been shown to be a useful therapeutic technique for a range of clinical conditions including nausea [34], depression [35], insomnia [36], and immunosuppression [37]. A *stimulatory* mechanism explaining acupuncture's effects in these and other non-pain related conditions has yet to be described, but there is certainly recent evidence that, for insomnia, at least, acupuncture is inhibitory [38]. Is there a unifying *inhibitory* mechanism through peripheral neural blockade which might explain acupuncture's wide-ranging effects on conditions other than pain? Acupuncture's effect on nausea is believed to involve gastric motility enhancement [39]. The stimulation of intestinal alpha-2 adrenoceptors inhibits gut motility [40], while the administration of alpha-2 adrenoceptor antagonist yohimbine results in enhanced motility [41]. If acupuncture blocked the C – fiber reflex known to activate visceral sympathetic efferents to the gut [42], this would result in enhanced motility through alpha-2 adrenoceptor blockade. Similarly, Yanpallewar et al. have demonstrated that alpha-2 adrenoceptor blockade has a potent anti-depressant effect [43], while alpha-2 adrenoceptor blockade has been shown to have a potent anxiolytic effect [44], which could readily be extrapolated to insomnia. In relation to immune modulation, alpha-2 adrenoceptor stimulation has been shown to induce immunosuppression [45], while blockade of these receptors results in immune enhancement [46]. Hence, acupuncture's effect on both painful and non-painful conditions can be explained by invoking neural blockade, either directly or via secondary blockade of sympathetic efferents that activate alpha-2 adrenoceptors.

Eastern and Western concepts of acupuncture

Eastern concepts of acupuncture invoke unblocking sites of impaired energy flow along meridians caused

by conditions such as stagnation of energy [1]. While this might explain acupuncture's local and distant effects in Traditional Chinese Medicine (TCM), there appears to be no obvious scientific correlate to meridians [47]. In contrast, Western concepts attribute acupuncture's local effects to A β fibre skin stimulation inhibiting painful stimuli from the periphery [47], thus reducing pain perception, based upon local dermatome selection [48]. Yet, this does not adequately explain distant effects, with the suggestion that acupuncture stimulates descending inhibition through activation of diffuse noxious inhibitory controls having recently shown to be unlikely [49], and other invoked mechanisms, such as release of endogenous opiates, not requiring acupoint specificity [47]. There is, however, evidence of convergence of spinal afferent processing between apparently unrelated viscera, which have specific parallels in TCM approaches. For example, Eastern concepts of acupuncture which pair lung and colon meridians [1] have correlates with recently demonstrated spinal cross-talk between lung and colon [50]. If meridians, as recently suggested [51], are subepidermal C – fiber afferents, then acupuncture blockade could be expected to have both local and distant effects, as well as influence apparently unrelated viscera such as lung and colon.

Hence, a case could be made for replacing the term “acupuncture stimulation” with “acupuncture blockade”. What are the implications for acupuncture practitioners of using the term “acupuncture blockade”? The alignment of acupuncture with other anesthetic techniques for neural blockade would, likely, be expected to promote this minimally invasive technique, and, potentially, bring it into mainstream clinical practice for pain management as well as other therapeutic applications. In addition, there would be substantial impetus for further research to finally elucidate acupuncture's mechanism of action.

Summary

While acupuncture has previously been deemed to be stimulatory, there is little published evidence to support using this term for the peripheral effect of the needle, laser or capsaicin used to induce the clinical effect. In contrast, there is recent evidence to suggest that acupuncture acts through an opposing peripheral mechanism – neural blockade – with this mechanism explaining the range of acupuncture techniques in use, its wide clinical application and both Eastern and Western concepts of acupuncture. Hence, it is suggested that consideration be given to acupuncture “stimulation” being re-named acupuncture “blockade”.

Competing interests

The author declares that he has no competing interests, either financial or non-financial in relation to this manuscript.

Authors' contribution

The author contributed to all aspects of the manuscript and was unassisted in this contribution.

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References

- Liu Z, Liu L: *Essentials of Chinese Medicine Volume 1*. London: Springer-Verlag; 2009.
- Han JS: Acupuncture and endorphins. *Neurosci Lett* 2004, **361**:258–261.
- Cheng RS, Pomeranz B: Monoaminergic mechanism of electroacupuncture analgesia. *Brain Res* 1981, **215**:77–92.
- Cheng R, McKibbin L, Roy B, Pomeranz B: Electroacupuncture elevates blood cortisol levels in naive horses; sham treatment has no effect. *Life Sci* 1980, **26**:631–8.
- Goldman N, Chen M, Fujita T, Xu Q, Peng W, Liu W, Jensen TK, Pei Y, Wang F, Han X, Chen JF, Schnermann J, Takano T, Bekar L, Tieu K, Nedergaard M: Adenosine A1 receptors mediate local anti-nociceptive effects of acupuncture. *Nat Neurosci* 2010, **13**:883–8.
- Dorsher PT: Clinical equivalence of laser needle to metal acupuncture needle in treating musculoskeletal pain: a pilot study. *Med Acupunct* 2010, **22**:11–17.
- Chow RT, Johnson MI, Lopes-Martins RA, Bjordal JM: Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomised placebo or active-treatment controlled trials. *Lancet* 2009, **374**:1897–908.
- Chow R, Armati P, Laako EL, Bjordal JM, Baxter GD: Inhibitory effects of laser irradiation on peripheral mammalian nerves and relevance to analgesic effects: a systematic review. *Photomed Laser Surg* 2011, **29**:365–81.
- Acar HV, Yilmaz A, Demir G, Günel Erucar S, Dikmen B: Capsicum plasters on acupoints decrease the incidence of emergence agitation in pediatric patients. *Paediatr Anaesth* 2012. doi:10.1111/j.1460-9592.2012.03876.x.
- Kim KS, Nam YM: The analgesic effects of capsicum plaster at the Zusanli point after abdominal hysterectomy. *Anesth Analg* 2006, **103**:709–13.
- Kissin I: Vanilloid-induced conduction analgesia: selective, dose-dependent, long-lasting, with a low level of potential neurotoxicity. *Anesth Analg* 2008, **b**:2712–281.
- Zunhammer M, Eichhammer P, Franz J, Hajak G, Busch V: Effects of acupuncture needle penetration on motor system excitability. *Neurophysiol Clin* 2012, **42**:225–30.
- Yeo S, Choe IH, van den Noort M, Bosch P, Lim S: Consecutive acupuncture stimulations lead to significantly decreased neural responses. *J Altern Complement Med* 2010, **16**:481–7.
- Thorsell A: Brain neuropeptide Y and corticotropin-releasing hormone in mediating stress and anxiety. *Exp Biol Med (Maywood)* 2010, **235**:1163–1167.
- Eshkevari L, Egan R, Phillips D, Tilan J, Carney E, Azzam N, Amri H, Mulrone SE: Acupuncture at ST36 prevents chronic stress-induced increases in neuropeptide Y in rat. *Exp Biol Med (Maywood)* 2012, **237**:18–23.
- Chen WH, Tzen JT, Hsieh CL, Chen YH, Lin TJ, Chen SY, Lin YW: Attenuation of TRPV1 and TRPV4 expression and function in mouse inflammatory pain models using electroacupuncture. *Evid Based Complement Alternat Med* 2012, **2012**:636848.
- Meng X, Zhang Y, Li A, Xin J, Lao L, Ren K, Berman BM, Tan M, Zhang RX: The effects of opioid receptor antagonists on electroacupuncture-produced anti-allodynia/hyperalgesia in rats with paclitaxel-evoked peripheral neuropathy. *Brain Res* 2011, **1414**:58–65.
- Hagiwara S, Iwasaka H, Okuda K, Noguchi T: GaAlAs (830 nm) low-level laser enhances peripheral endogenous opioid analgesia in rats. *Lasers Surg Med* 2007, **39**:797–802.
- Hsieh JC, Stahle-Backdahl M, Hagermark O, Stone-Elander S, Rosenquist G, Ingvar M: Traumatic nociceptive pain activates the hypothalamus and the periaqueductal gray: a positron emission tomography study. *Pain* 1996, **6**:303–314.
- Zyloney CE, Jensen K, Polich G, Loiotile RE, Cheetham A, LaViolette PS, Tu P, Kapchuk TJ, Gollub RL, Kong J: Imaging the functional connectivity of the periaqueductal gray during genuine and sham electroacupuncture treatment. *Mol Pain* 2010, **6**:80–86.
- Sailer A, Molnar GF, Cunic DI, Chen R: Effects of peripheral sensory input on cortical inhibition in humans. *J Physiol* 2002, **544**:617–629.
- Silberstein M: The cutaneous intrinsic visceral afferent nervous system: a new model for acupuncture analgesia. *J Theor Biol* 2009, **261**:637–642.
- Silberstein M, Adcroft K, Wan A, Massi M: Afferent neural branching at human acupuncture points: do needles stimulate or inhibit? *Med Acupunct* 2012, **24**:38–42.
- Langevin HM, Churchill DL, Fox JR, Badger GJ, Garra BS, Krag MH: Biomechanical response to acupuncture needling in humans. *J Appl Physiol* 2001, **91**:2471–8.
- Cai X: A new tr(i)p to sense pain: TRPA1 channel as a target for novel analgesics. *Expert Rev Neurother* 2008, **8**:1675–81.
- Torebjörk EH, Hallin RG: Responses in human A and C fibres to repeated electrical intradermal stimulation. *J Neurol Neurosurg Psychiatry* 1974, **37**:653–664.
- Langevin HM, Yandow JA: Relationship of acupuncture points and meridians to connective tissue planes. *Anat Rec* 2002, **269**:257–65.
- Wu MT, Sheen JM, Chuang KH, Yang P, Chin SL, Tsai CY, Chen CJ, Liao JR, Lai PH, Chu KA, Pan HB, Yang CF: Neuronal specificity of acupuncture response: a fMRI study with electroacupuncture. *Neuroimage* 2002, **16**:1028–37.
- Yan B, Li K, Xu J, Wang W, Li K, Liu H, Shan B, Tang X: Acupoint-specific fMRI patterns in human brain. *Neurosci Lett* 2005, **383**:236–240.
- Wu Y, Jin Z, Li K, Lu ZL, Wong V, Han TL, Zheng H, Caspi O, Liu G, Zeng YW, Zou LP: Functional magnetic resonance imaging activation of the brain in children: real acupoint versus sham acupoint. *J Child Neurol* 2010, **25**:849–855.
- Bäumler PI, Simang M, Kramer S, Irnich D: Acupuncture point localization varies among acupuncturists. *Forsch Komplementmed* 2012, **19**:31–37.
- Habib AS: Do we really understand what constitutes an acupuncture point? Commentary on a paper by Molsberger et al. (this issue). *Eur J Pain* 2012. doi:10.1002/j.1532-2149.2012.00168.x.
- Hsieh LL, Kuo CH, Lee LH, Yen AM, Chien KL, Chen TH: Treatment of low back pain by acupuncture and physical therapy: randomised controlled trial. *BMJ* 2006, **332**:696–700.
- Lee A, Fan LT: Stimulation of the wrist acupuncture point P6 for preventing postoperative nausea and vomiting. *Cochrane Database Syst Rev* 2009. doi:10.1002/14651858.CD003281.pub3.
- Zhang ZJ, Chen HY, Yip KC, Ng R, Wong VT: The effectiveness and safety of acupuncture therapy in depressive disorders: systematic review and meta-analysis. *J Affect Disord* 2010, **124**:9–21.
- Cao H, Pan X, Li H, Liu J: Acupuncture for treatment of insomnia: a systematic review of randomized controlled trials. *J Altern Complement Med* 2009, **15**:1171–86.
- Lu W, Hu D, Dean-Clower E, Doherty-Gilman A, Legedza AT, Lee H, Matulonis U, Rosenthal DS: Acupuncture for chemotherapy-induced leukopenia: exploratory meta-analysis of randomized controlled trials. *J Soc Integr Oncol* 2007, **5**:1–10.
- Huang W, Kutner N, Bliwise DL: Autonomic activation in insomnia: the case for acupuncture. *J Clin Sleep Med* 2011, **7**:95–102.
- Chen J, Song GQ, Yin J, Koothan T, Chen JD: Electroacupuncture improves impaired gastric motility and slow waves induced by rectal distension in dogs. *Am J Physiol Gastrointest Liver Physiol* 2008, **295**:G614–20.
- Stebbing M, Johnson P, Vremec M, Bornstein J: Role of alpha(2)-adrenoceptors in the sympathetic inhibition of motility reflexes of guinea-pig ileum. *J Physiol* 2001, **534**:465–78.
- Fioramonti J, Berlan M, Fargeasi MJ, Bueno L: Yohimbine stimulates colonic motility through a central action in conscious dogs. *Neurogastro Motil* 1992, **4**:137–141.
- Kametani H, Sato A, Sato Y, Simpson A: Neural mechanisms of reflex facilitation and inhibition of gastric motility to stimulation of various skin areas in rats. *J Physiol* 1979, **294**:407–18.
- Yanpallewar SU, Fernandes K, Marathe SV, Vadodaria KC, Jhaveri D, Rommelfanger K, Ladiwala U, Jha S, Muthig V, Hein L, Bartlett P, Weinschenker D, Vaidya VA: Alpha2-adrenoceptor blockade accelerates the neurogenic, neurotrophic, and behavioral effects of chronic antidepressant treatment. *J Neurosci* 2010, **30**:1096–109.

44. Sevy S, Papadimitriou GN, Surmont DW, Goldman S, Mendlewicz J: **Noradrenergic function in generalized anxiety disorder, major depressive disorder, and healthy subjects.** *Biol Psychiatry* 1989, **25**:141–52.
45. Felsner P, Hofer D, Rinner I, Porta S, Korsatko W, Schauenstein K: **Adrenergic suppression of peripheral blood T cell reactivity in the rat is due to activation of peripheral alpha 2-receptors.** *J Neuroimmunol* 1995, **57**:27–34.
46. Cupic V, Colic M, Pavicic L, Vucevic D, Varagic VM: **Immunomodulatory effect of xylazine, an alpha(2) adrenergic agonist, on rat spleen cells in culture.** *J Neuroimmunol* 2001, **113**:19–29.
47. Filshie J, White A: *Medical acupuncture: a Western scientific approach.* Philadelphia: Elsevier; 2005.
48. Mann F: *Scientific aspects of acupuncture.* London: Heinemann Medical Books; 1983.
49. Schliessbach J, van der Klift E, Siegenthaler A, Arendt-Nielsen L, Curatolo M, Streitberger K: **Does acupuncture needling induce analgesic effects comparable to diffuse noxious inhibitory controls?** *Evid Based Complement Alternat Med* 2012, **2012**:785613 doi:10.1155/2012/785613.
50. Qin C, Foreman RD, Farber JP: **Inhalation of a pulmonary irritant modulates activity of lumbosacral spinal neurons receiving colonic input in rats.** *Am J Physiol Regul Integr Comp Physiol* 2007, **293**:R2052–8.
51. Silberstein M: **Do acupuncture meridians exist? Correlation with referred itch (mitempfindung) stimulus and referral points.** *Acupunct Med* 2012, **30**:17–20.

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