

Japanese Acupuncture - Current Research

Effects of Electroacupuncture Analgesia on Postoperative Pain after Abdominal Surgery and the Presence of Endogenous Analgesic Substances

Keisou Ishimaru

Faculty of Health Sciences, Ryotokuji University

Introduction

We investigated the effects of electroacupuncture through a systematic review of randomized controlled trials (RCTs) in postoperative pain. 1)

The results are based on fifteen RCTs comparing electroacupuncture with sham control in the management of acute postoperative pain.

The results included one Japanese study (RCTs) by Ishimaru et al (1999). 2-3)

We have previously reported that electroacupuncture decreased the postoperative pain after abdominal surgery and significantly reduced the use of analgesic drugs, however, the mechanism of electroacupuncture analgesia has not been completely explained. In this study, The effects of surgical invasion and electroacupuncture analgesia on serum beta-endorphin, an endogenous opioid peptide that is involved in analgesic action, and adrenocorticotrophic hormone (ACTH) levels were evaluated.

Methods

Continuous frequency 3Hz electroacupuncture treatment was performed at acupuncture point LI4 (Hegu) and S36 (Zusanli) for 3 hours from 3 hours after the operation in 11 patients (electroacupuncture group). Another eleven patients not treated by non-electroacupuncture served as controls. Peripheral blood (5 ml) was collected before, during, immediately after operation and at 3 hour intervals thereafter until 12 hours after the operation, and serum beta-endorphin and ACTH levels were measured by radioimmunoassay (RIA).

Results

Surgical procedure and anesthesia time and changes in serum beta-endorphin and ACTH from

before operation until 12 hours after operation in the electroacupuncture group and non-electroacupuncture control group.

During the operations, both beta-endorphin and ACTH levels increased significantly. After the operations, these levels tended to gradually decrease to preoperative values, but the levels of serum beta-endorphin increased significantly again during the electroacupuncture treatment in the electroacupuncture group (Table 1.2.).

The degree of the postoperative pain in the electroacupuncture and non-electroacupuncture group and the consumption of the analgesic drugs (Table 3.4.).

Analgesic drugs for postoperative pain were used in 10 of the 11 cases in the control non-electroacupuncture group (Table 4.), but were used only in 1 of the 11 cases in the electroacupuncture group (Table 3).

These results suggest that the beta-endorphin levels induced by electroacupuncture reduced the postoperative pain. The results also suggest that, even under general anesthesia, the surgical invasions appear to induce the central nervous to activate stress-induced analgesia.

Discussion

In these results, we found that electroacupuncture is effective for postoperative pain management, as demonstrated by a significant reduction of postoperative pain scores and endogenous opioids including beta-endorphins. From other studies, likewise electroacupuncture may reduce analgesic drugs usage in the early postoperative period. 4-9)

Some studies suggested that electroacupuncture mechanisms include activation of the endogenous pain inhibitory system, release of endogenous opioids including beta-endorphins, enkephalins, and dynorphins, and non-opioid substances such as serotonin, norepinephrine, adenosine A1 receptor.10)

Future studies (RCTs) should investigate electroacupuncture mechanisms given before or after surgery.

patients No.	age	sex	surgical procedure	duration of anesthesia (minutes)	before ope	during ope	after ope	Serum beta-endorphin pg/ml				
								Serum ACTH pg/ml				
								3 hours EA	6 hours	9 hours	12 hours	
1	67	F	choledochojunostomy	220	3 55	41 370	47 150	10 90	8 70	10 50	10 50	
2	71	M	colectomy	170	3 19	38 90	53 90	7 71	6 52	3 30	3 13	
3	71	M	total gastrectomy	395	5 49	47 170	25 140	8 98	4 80	4 71	5 70	
4	57	F	cholecystectomy	160	2 60	22 260	26 370	8 99	22 60	26 70	8 49	
5	67	M	cholecystectomy	75	4 15	30 180	12 89	11 89	15 60	6 13	6 13	
6	41	M	subtotal gastrectomy	175	7 28	44 350	32 380	11 40	28 30	18 27	7 28	
7	57	M	subtotal gastrectomy	210	3 8	37 420	4 60	20 210	16 10	3 16	3 8	
8	65	F	high anterior resection	166	5 45	66 790	24 270	9 19	15 9	16 8	4 10	
8	88	M	miles operation and descending colostomy	225	2 90	62 580	46 540	22 190	33 60	46 40	14 60	
10	82	F	subtotal gastrectomy	200	6 82	44 160	45 130	40 92	45 95	23 80	10 30	
11	53	F	subtotal gastrectomy	166	4 20	64 320	46 540	22 90	33 60	40 40	14 60	
65.3±13.2 years					196.4±77.5	4.0±1.6 42.8±27.4	45.0±14.0 335.4±205.7	32.7±15.9 250.8±180.0	15.2±10.0 98.9±56.1	20.4±13.0 53.2±27.0	17.7±14.8 40.4±24.8	7.6±3.9 32.0±21.7

Table 1. Surgical procedure and anesthesia time and changes in serum beta-endorphin and ACTH from before operation until 12 hours after operation in the electroacupuncture group. Normal value : Serum beta-endorphin 1-10 pg/ml, Serum ACTH 5.5-50 pg/ml. EA : Electroacupuncture stimulation.

patients No.	age	sex	surgical procedure	duration of anesthesia (minutes)	before ope	during ope	after ope	Serum beta-endorphin pg/ml				
								Serum ACTH pg/ml				
								3 hours	6 hours	9 hours	12 hours	
1	63	M	subtotal gastrectomy	150	3 52	25 350	4 140	3 60	3 50	3 40	3 -	
2	68	M	high anterior resection	225	3 37	35 190	9 90	8 90	3 63	3 55	3 38	
3	70	M	sigmoidectomy	150	7 27	6 180	9 98	8 82	7 80	5 59	7 52	
4	81	M	cholecystectomy	120	5 16	14 83	13 64	3 5	13 6	5 5	6 5	
5	74	M	subtotal gastrectomy	215	6 35	16 110	20 160	8 19	8 14	8 12	9 17	
6	71	M	low anterior resection	210	4 33	33 160	23 82	28 120	23 30	19 18	20 30	
7	74	M	total gastrectomy	225	5 24	44 210	48 320	16 54	15 66	- -	- -	
8	31	M	subtotal gastrectomy	180	5 19	34 640	33 450	6 18	7 24	6 28	5 19	
8	80	F	cholecystectomy	50	3 31	4 45	8 75	3 18	3 10	3 16	3 31	
10	69	M	subtotal gastrectomy and cholecystectomy	290	5 60	36 460	30 130	23 60	10 30	7 60	6 53	
11	70	F	total gastrectomy	205	9 80	29 180	22 149	21 93	18 80	14 80	10 60	
68.2±13.4 years					183.6±64.0	5.0±1.8 37.6±19.2	25.0±13.2 237.1±178.0	19.9±13.2 159.8±119.3	11.5±8.9 56.2±37.6	10.0±6.6 41.1±27.7	7.3±5.2 37.3±25.2	7.2±5.1 33.8±18.5

Table 2. Surgical procedure and anesthesia time and changes in serum beta-endorphin and ACTH from before operation until 12 hours after operation in the non-electroacupuncture group. Normal value : Serum beta-endorphin 1-10 pg/ml, Serum ACTH 5.5-50 pg/ml.

patients No.	after ope	Postoperative pain and the relations of the use pain-killer			
		3 hours EA	6 hours	9 hours	12 hours
1	2	2	1	0	0
2	2	2	1	1	0
3	2	2	0	0	0
4	2	2	0	0	0
5	1	1	1	0	0
6	2	2	1	1	0
7	2	2	3 Voltaren50mg	1	0
8	1	1	1	0	0
9	2	2	1	0	0
10	2	2	0	0	0
11	2	2	1	1	0

Table 3. The degree of the postoperative pain in the electroacupuncture group and the consumption of the analgesic drugs.

EA: Electroacupuncture stimulation.

The evaluation of the pain. 0:no pain, 1: movement pain, 2:rest pain, 3: use of the analgesic drugs.

patients No.	after ope	Postoperative pain and the relations of the use pain-killer			
		3 hours	6 hours	9 hours	12 hours
1	2	2	3 pentazocin 1A	1	0
2	1	1	1	1	1
3	2	2	3 voltaren 50mg	1	0
4	2	2	3 pentazocin 1A	1	0
5	2	2	2	3 voltaren 25mg	1
6	2	1	2	3 voltaren 25mg	1
7	1	3 pentazocin 1A	3 voltaren 25mg	2	2
8	2	2	3 voltaren 25mg	0	0
9	2	2	3 voltaren 25mg	0	0
10	1	2	3 voltaren 25mg	1	0
11	2	2	3 voltaren 50mg	2	2

Table 4. The degree of the postoperative pain in the non-electroacupuncture group and the consumption of the analgesic drugs.

The evaluation of the pain. 0:no pain, 1: movement pain, 2:rest pain, 3: use of the analgesic drugs.

Conclusion

Electroacupuncture treatment may be a useful complementary and alternative medicine for acute postoperative pain management.

Acknowledgements

This work was supported by a grant for scientific research from the Ministry of Education Science and Culture of Japan (0977076), 1998-1999.

References

- 1) Sun Y, Gan TJ et al : Acupuncture and related techniques for postoperative pain: a systematic review of randomized controlled trials. *Brit J Anaesth*. 2008;101:151-160.
- 2) Ishimaru K : Effects of acupuncture analgesia on post-operative pain after abdominal surgery and the relationship of endogenous analgesic substances. *Meiji Shinkyu Igaku. Bull Meiji Univ Orient Med*. 2000;26:11-22.
- 3) Ishimaru K, Imai K et al : Effects of acupuncture analgesia on post-operative pain after abdominal surgery using serum β -endorphin and ACTH concentration as parameters. *The Journal of the japan society of pain clinicians*. 1999;1:6:10-16.
- 4) Wang B, Tang J et al : Effect of the intensity of transcutaneous acupoint electrical stimulation on the postoperative analgesic requirement. *Anesth Analg*. 1997;85:406-413.
- 5) Chen L, Tang J : The effect of location of transcutaneous electrical nerve stimulation on postoperative opioid analgesic requirement: acupoint versus nonacupoint stimulation. *Anesth Analg*. 1998;87:1129-1134.
- 6) Kotani N, Hashimoto H : Pre-operative intradermal acupuncture reduces postoperative pain, nausea and vomiting, analgesic requirement, and sympathoadrenal responses. *Anesthesiology*. 2001;95:349-356.
- 7) Lin JG, Lo MW : The effect of high and low frequency electroacupuncture in pain after lower abdominal surgery. *Pain*. 2002;99:509-514.
- 8) Sim CK, Xu PC : Effects of electroacupuncture on intraoperative and postoperative analgesic requirement. *Acupunct Med*. 2002; 20:56-65.
- 9) Wong RH, Lee TW : Analgesic effect of electroacupuncture in postthoracotomy pain: a prospective randomized trial. *Ann Thorac Surg*. 2006; 81:2031-2036.
- 10) Goldman N, Chen M et al : Adenosine A1 receptors mediate local anti-nociceptive effects of acupuncture. *Nat Neurosci*. 2010;13(7):883-8.