

Research Progress on Traditional Chinese Medicine in Pain after Lumbar Interbody Fusion

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Abstract: By analyzing and summarizing the relevant literature in recent years, this paper expounds the high-risk factors of pain after lumbar interbody fusion and the mechanism of traditional Chinese medicine in the treatment of postoperative pain after lumbar fusion. The high risk factors of postoperative pain after lumbar fusion mainly include operation mode, patient factors, postoperative infection and so on; Acupuncture, auricular points, traditional Chinese medicine, acupoint application and other traditional Chinese medicine characteristic therapies can effectively improve postoperative pain with little side effects, which is worthy of clinical application.

1. Introduction

Lumbar interbody fusion is a common surgical procedure used to treat lumbar spondylolisthesis, lumbar stenosis, lumbar disc disease, and lumbar instability [1-2]. The trauma of lumbar fusion is large, the amount of intraoperative blood is large, and the postoperative pain is severe. It is reported that the probability of low back pain within 2 years after lumbar fusion is 3% to 4% [3]. Effective control of pain is of great significance for improving the curative effect of surgery, shortening the length of hospital stay, improving patient satisfaction and speeding up the speed of recovery [4]. At present, how to effectively analgesia is a difficult problem faced by clinicians, and the use of traditional Chinese medicine for postoperative analgesia has become a hot topic.

There are many postoperative analgesia modes, which have not been unified at present. In recent years, multi-modal analgesia proposed by Western medicine has been recognized in many analgesic modes [5]. Multi-modal analgesia refers to the combination of analgesic drugs with different mechanisms and different analgesic methods, so that the analgesic effects are superimposed or coordinated [6]. However, the cost of multi-mode analgesia is high [7], and various analgesics have greater side effects, and there is no clear research to show which analgesics combined use can reduce side effects and have more prominent effects. In recent years, the application of traditional Chinese medicine in the operation and postoperative analgesia has achieved remarkable effects, can reduce many postoperative adverse reactions, with green safety, effective, low cost and other advantages. The author summarized the causes of postoperative pain after lumbar fusion, and the mechanisms and

methods of TCM treatment of postoperative pain in recent years.

2. The etiology of postoperative pain after lumbar spine fusion

The causes of pain after lumbar fusion are complex and diverse, and the main reasons are surgical factors, patient factors, incision site infection, and mental factors [8]. Grasping the high risk factors is conducive to reducing the degree of postoperative pain and reducing the probability of lower back and lower limb pain within 2 years.

2.1. Surgical Factors

There are various lumbar fusion methods, but there is no unified standard for specific clinical selection methods, and different fusion methods have their advantages and disadvantages. Gu [9] et al. retrospectively analyzed 401 patients with lumbar spine surgery methods and operation time, and compared the postoperative visual analogue scale (VAS) scores and imaging characteristics of patients with different surgical methods and operation time, and concluded that the longer the operation time, the higher the risk of postoperative low back pain. Tang Qiang [10] et al., by comparing the placement direction of the interbody fusion cage, concluded that the transverse placement of the interbody fusion cage could better maintain the height of the intervertebral space and reduce the occurrence of postoperative screw rod fracture and low back pain. Luo Yi [11] et al. concluded by comparing different bone graft fusion methods that the choice of different bone graft fusion methods directly affected the bone fusion rate, indirectly affected the bone healing in the fusion area, and reflexively caused low back pain. In summary, clinicians need to scientifically and reasonably select surgical methods for patients according to their own condition characteristics, so as to reduce the probability of postoperative pain in the lower back and lower limbs.

2.2. Patient Factors

Postoperative pain is closely related to individual factors such as age, gender and weight. Judy [12] et al. found that although the gender of patients had no significant effect on the postoperative quality of life (ODI) score, the VAS score of low back pain after lumbar fusion in female patients was higher than that in male patients as a whole. Patients with lower limb numbness before operation have higher VAS score after operation, which may be related to irreversible deformation of nerve tissue caused by spinal stenosis compressing nerve roots. Patients with a history of spinal surgery had a relatively higher VAS score of postoperative leg pain. Gautschi O P [13] et al. found that the functional improvement of elderly patients after lumbar surgery was slower than that of young patients. Preoperative measures should be taken for older patients with other chronic diseases, especially for diabetic patients, blood glucose should be strictly detected during the perioperative period to avoid risks.

2.3. Infection Factors

Infection is one of the most common adverse events in the perioperative period of spinal surgery, and it is also one of the causes of postoperative lower limb pain. Smith H [14] et al. believed that postoperative infection included postoperative incision infection, organ infection or infection of the cavity. Hansen [15] et al. found that the causes of surgical site infection (SSI) after spinal surgery include both preoperative and intraoperative causes. Preoperative risk variables included age, sex, BMI, smoking, diabetes mellitus, coronary artery disease, and history of malignancy. Intraoperative risk variables included physician aseptic manipulation, device use, blood loss, and operative time. The high risk factors should be comprehensively evaluated before surgery to formulate corresponding preventive measures, and the intraoperative aseptic principle should be strictly followed to prevent

and control the high risk factors easy to cause infection. Wang Shiyong [16] et al. retrospectively analyzed the cases of patients undergoing lumbar fusion and concluded that the three factors of intraoperative bleeding, postoperative drainage, and blood transfusion are not independent, and may jointly affect the occurrence of SSI. Making clear the high risk factors prone to infection is conducive to timely prevention and control measures to reduce a series of adverse consequences caused by infection.

2.4. Psychological Factors

The International Association for the Study of Pain considers pain as an existing or potential tissue injury, or an unpleasant sensory and emotional experience described for such injury [17]. So pain is not a simple physiological factor, but also closely related to individual psychology, emotion and cognition. There have been some studies at home and abroad to reduce the postoperative patients' perception of pain through preoperative psychological intervention, but most doctors still stay with routine analgesia to improve the pain. Through investigation and research, Christine [18] et al. found that patients diagnosed with anxiety or depression before surgery had a much higher probability of suffering pain in the lower back or lower limbs within three months after surgery than patients with stable emotions. Patients with relief of depression and anxiety after surgery will also have a decrease in postoperative VAS score. Studies have shown that optimism is related to endogenous pain processing mechanisms. Optimism can activate the prefrontal cortex and anterior cingulate cortex of the brain, and inhibit the activation of pain processing regions, such as the insula and secondary somatosensory cortex. In addition, patients' negative reaction to the future can also increase pain [19]. Therefore, preoperative psychological counseling and postoperative close attention to patients' psychological changes are also a key measure to prevent pain. Especially for the patients with obvious fear and anxiety, more attention should be paid to humanistic care.

3. Knowledge of pain after lumbar fusion

The understanding of pain in traditional Chinese medicine is generally divided into two categories, namely, "Lack of stagnation of qi and blood leading to pain" and "Lack of qi and blood nourishment leading to pain". Surgery will inevitably damage qi-blood and fluid and sinews, qi deficiency will be unable to promote the blood circulation, qi deficiency and blood stasis will affect each other, and over time, both qi and blood will be deficient [20]. Pain is also related to Arthralgia syndrome of traditional Chinese medicine. Arthralgia syndrome is on the base of deficient right-Qi, the pathogenic wind, cold, wet, heat attack the human body, block muscle, channel and joints and cause stagnant movement of Qi and blood. Patients are prone to tension, anxiety and other emotions during the perioperative period. Abnormal emotions can lead to stagnation of liver qi, and liver dysfunction can cause systemic qi dysfunction, which often causes or aggravates postoperative pain. In view of the etiology and pathogenesis of postoperative pain, Chinese medicine carries out clinical syndrome differentiation according to the specific conditions of patients, mainly starting with promoting blood circulation to remove blood stasis and nourishing liver and kidney, plus regulating the liver-qi, which can often play a good clinical effect.

4. Traditional Chinese medicine treatment of pain after lumbar spine fusion

4.1. Acupuncture Treatment

Acupuncture analgesia is one of the main means of pain treatment in TCM, and it is also a widely accepted analgesic method in western countries. Jiaji acupoint has significant clinical effect on severe low back pain [21]. And "Miraculous Pivot" informs us, "It is necessary to use micro-acupuncture to dredges the meridians and regulate the qi and blood". The principle of acupuncture analgesia also lies

in dredging channels and regulating qi and blood. Especially after surgery, most patients have qi stagnation and blood stasis or qi deficiency and blood stasis, and acupuncture can regulate qi and blood to relieve pain. “Huangdi Neijing” says, “Every Method of acupuncture must first be from God”. Both traditional medicine and modern medicine believe that pain is inseparable from people's emotional cognition. Pain can lead to emotional abnormalities, further block the operation of qi movement, and aggravate pain. While acupuncture focuses on regulating the mind, and regulating qi and blood complement each other to inhibit pain.

4.1.1. Promoting the Release of Neurotransmitters

Acupuncture or electroacupuncture can promote the release of certain neurotransmitters in the central nervous system, the most important of which is the release of opioid peptides, and activate the sympathetic or parasympathetic nervous system [22]. The release of these neurotransmitters can trigger a series of physiological responses, including analgesia, regulation of visceral function, and immune regulation. Acupuncture can stimulate the hypothalamus to release β -endorphin, increase the level of interferon- γ (IFN- γ) and increase the activity of NK cells, which is equivalent to the release of natural analgesics to relieve pain [23]. Dong Hua [24] et al. believe that acupuncture can reduce plasma pain-related factors and increase the content of endogenous opioid peptides to play an analgesic role. Zhang Yiping [25] et al. found that acupuncture at Zusanli can increase the content of serum β -enka peptide in rats with arthritis in the acute stage, increase the pain threshold of rats, and thus play an analgesic role.

4.1.2. Inhibition of Microglia Activation

Studies have shown [26] that glial cells (microglia and astrocytes) in the spinal dorsal horn are involved in the inflammatory response and the occurrence and development of neuropathic pain. Nerve injury caused by surgery or postoperative wound infection can trigger inflammatory responses, and the release of a variety of inflammatory cytokines is also a key factor inducing postoperative chronic pain [27]. Through the mouse model of traumatic brain injury (TBI) induced by acupuncture, Lin Shujun et al. [28] showed that on the 14th day of treatment, the neuronal damage and necrosis in the acupuncture group were gradually improved, and the activated microglia were reduced. In conclusion, acupuncture can regulate the secondary neuroinflammatory response after TBI by inhibiting the activation of microglia, thereby promoting the recovery of neurological function. However, acupuncture can prevent the activation of microglia mainly by inhibiting the microglial signaling pathway, including mitogen-activated protease (MAPK), phosphatidylinositol 3-kinase/protein kinase B (PI3K/Akt), etc [29]. In conclusion, acupuncture can relieve pain by promoting the release of neurotransmitters, inhibiting the activation of microglia and increasing the pain threshold.

4.1.3. Acupoint Selection

Acupuncture has analgesic effect, but different acupuncture points, acupuncture intensity and electric acupuncture frequency can affect the analgesic effect. In order to avoid infection, near point selection should be avoided after acupuncture treatment of lumbar fusion. Liu Yingjie [30] et al. found through clinical observation that acupuncture at Weizhong point can effectively improve residual lumbar and back pain after lumbar surgery, and the short-term effect is better than drug treatment. Chang K H et al. [31] compared the analgesic effect of acupuncture at Zusanli, Yinlingquan and Kunlun points by observing the cringe behavior and c-Fos expression of spinal dorsal horn in mice model of pain induced by formalin, and showed that all three points had analgesic effect, but the analgesic effect of Kunlun point was better than Zusanli and Yinlingquan point in pain caused by inflammation. Kunlun acupoint is located in the bladder meridian, and the injured parts of lumbar fusion surgery also belongs to the bladder meridian and the Du vein. Kunlun acupoint belongs to the

patrol and selected point, but also belongs to the remote acupoint. Acupuncture Zusanli after operation can promote the recovery of gastrointestinal motor function and prevent pain caused by intestinal obstruction and gastrointestinal dysfunction [32]. Mental anxiety can also cause pain, choose Neiguan point to regulate emotions, relieve anxiety. In conclusion, the treatment of lumbar fusion after acupuncture should be based on zhong, Kunlun, Zusanli, Hegu and Neiguan points, combined with the syndrome differentiation of the patient's condition.

4.2. Auricular Acupuncture Therapy

Auricular point analgesia is a major feature of acupuncture therapy, which has been proved by a large number of clinical practices. Auricular points are closely related to cranial nerves, and auricular point acupuncture can stimulate a variety of receptors, especially pain receptors. Modern studies have proved that auricular points can exert analgesia by stimulating the descending pain inhibition pathway of the dorsal horn cells along the dorsal part of the spinal cord and increasing the concentration of β -engaetin [33]. Through years of research on the application of auricular acupuncture along the skin, Jia found that auricular acupuncture can play a rapid analgesic effect on cervical spondylosis, migraine, lumbar disc herniation, postoperative pain and other diseases [34-36]. Nie Chengcheng [37] explored the application effect of comprehensive traditional Chinese medicine nursing in the rapid rehabilitation of patients with lumbar spine surgery, carried out auricular point nursing according to different symptoms of patients, and found that patients' symptoms such as nausea and vomiting were significantly relieved, and their pain was also improved. Multimodal analgesia with auricular acupuncture can significantly relieve postoperative pain, reduce the use of opioids, and promote the recovery of gastrointestinal function. Bloodletting therapy behind the ear has the effects of removing blood stasis, dredging meridians and harmonizing qi and blood [38], which can not only promote postoperative blood circulation, prevent the formation of deep vein thrombosis of lower limbs after lumbar fusion, but also play an analgesic effect.

4.3. Treatments with traditional Chinese medicine

During lumbar fusion, qi, blood and body fluid are directly damaged, or the patient's blood is weak to run due to qi deficiency, resulting in qi deficiency and blood stasis, or qi stagnation and blood stasis caused by poor blood circulation due to immobilization in bed after surgery. The general principle of postoperative treatment should be to invigorate qi, promote blood circulation and remove blood stasis, and replenish the liver and kidney. Modern studies have shown that oral administration of Chinese herbs for promoting blood circulation and removing blood stasis can promote local blood circulation and relieve postoperative pain. Zheng Yifei [39] observed the effect of acupuncture combined with Buzhongyiqi decoction on the coagulation state after posterior single-level interbody fusion in the elderly. The results showed that acupuncture combined with BuzhongYiqi decoction could effectively improve postoperative coagulation and reduce the risk of bleeding and thrombosis. Yang Xunbo [6] et al. randomly divided 29 patients with lumbar spinal stenosis undergoing posterior lumbar decompression and interbody fusion and internal fixation into two groups. The conventional analgesia group was treated with celecoxib orally, and the multimodal analgesia group was treated with acupuncture and Huangqi Guizhi Wuwu decoction on the basis of the conventional analgesia. The results showed that the VAS scores of multimodal analgesia group were lower than those of conventional analgesia group at different time points after operation, and the difference was statistically significant ($P < 0.05$). In conclusion, oral administration of traditional Chinese medicine after surgery has better analgesic effect than single oral western medicine, and accelerates the recovery of patients.

4.4. Treatment of Chinese medicine at the accupoint

The acupoint application of traditional Chinese medicine has the effect of reducing swelling, relieving pain, relaxing tendon and dredging collaterality. It is often used in clinical nursing after various surgeries, which not only relive postoperative pain, but also promote the recovery of gastrointestinal function after surgery [40]. Wang Guanlin [41] et al. divided 60 patients with low back pain after lumbar surgery into a treatment group and a control group. The treatment group was treated with blade knife combined with traditional Chinese medicine plaster, and the control group was treated with oral non-steroidal anti-inflammatory drugs (celecoxib). The VAS scores of the two groups were compared within the group ($P < 0.05$) and between the groups ($P < 0.05$), and VAS scores were improved after treatment. The improvement of low back pain in the treatment group was significantly better than that in the control group. Tian Chunyan [42] et al. randomly divided 120 patients after total hip replacement into the observation group and the control group. The observation group was given moxibustion and acupoint application combined with intervention. The control group received postoperative routine treatment, and the two groups were intervened for 4 weeks. The results showed that the lower limb pain of the observation group was significantly less than that of the control group, and the VAS scores of lower limb pain at 2, 3 and 5 days after operation were significantly lower than those of the control group ($P < 0.05$). Lin Yuying [43] et al. found that Yongquan acupoint tapping combined with traditional Chinese medicine acupoint application could improve the abdominal distension of patients after lumbar fusion surgery, and the first recovery time of bowel sounds was advanced. The application of traditional Chinese medicine plaster after lumbar fusion can not only promote blood circulation, relieve pain, promote local microcirculation, but also accelerate the recovery of gastrointestinal function, which has high clinical value.

4.5. Traditional Chinese medicine sentiment nursing

Perioperative patients often have anxiety, fear and other emotions, which is one of the causes of postoperative pain [2]. Traditional Chinese medicine believes that emotional abnormalities can lead to the abnormal dispersion of Gan and Qi-ji disorder. According to Huangdi Neijing, "the liver governing tendons, the kidney governing bones." liver and kidney homologous, bones and muscles integrated, Therefore, soothing liver and raising blood and smoothing emotions are also the keys to accelerate postoperative recovery of patients [44]. Liu Yuan-yuan [45] found that patients with thoracolumbar fracture surgery treated with TCM emotional nursing combined with comfort nursing had lower pain scores and higher pain tolerance than those treated with conventional nursing alone. Yan Xiaoheng [46] randomly divided 80 patients with orthopedic surgery into two groups. The improvement of pain symptom score in the TCM emotional nursing group was significantly better than that in the control group, and the difference between the two groups was statistically significant ($P < 0.05$). According to the different syndrome types of patients, the individual guidance of TCM emotional nursing includes music therapy, oral Chinese medicine, acupuncture and massage and so on. It can effectively improve the negative emotions of patients, promote flow of qi and blood, reduce the postoperative pain of patients, and accelerate the recovery of patients. It is worthy of clinical application and promotion.

5. Summary and Prospect

The causes of postoperative pain after lumbar fusion are closely related to surgical methods, age of patients, postoperative infection and other factors. Clinicians should scientifically and reasonably develop a treatment plan for each patient, avoid risks, reduce the degree of postoperative pain, and reduce the hospital stay time of patients. Conventional western medicine analgesia may cause bleeding, respiratory depression, urinary retention, and other side effects of nausea [47]. Through different mechanisms of action, TCM analgesia can reduce the use of postoperative analgesics, reduce

a series of adverse reactions caused by analgesics, accelerate the recovery of gastrointestinal function, shorten the length of hospital stay, and reduce hospitalization costs.

With the progress of pain research, researchers have gradually realized that pain includes three dimensions: pain sensation, pain emotion and pain cognition, that is, the multi-dimensional model of "pain-emotion-cognition" [48]. Traditional Chinese medicine characteristic therapy, such as acupuncture, traditional Chinese medicine, acupoint application and emotional nursing, with individual syndrome differentiation, is in line with the concept of multidimensional analgesia mode. However, the mechanism of TCM treatment of postoperative pain after lumbar fusion has not been fully explained, which requires a lot of basic research to guide the clinical practice, in order to obtain better efficacy. The author believes that in the future, postoperative analgesia for lumbar fusion will tend to be an all-round and multi-dimensional mode, and TCM will play a positive role with its unique advantages.

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