

Progress of Research on the Treatment of Seroma after Inguinal Hernia Repair by Chinese and Western Medicine

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Abstract: Seroma is a common complication after inguinal hernia repair, which can worsen postoperative pain, cause anxiety and discomfort, and create a psychological burden for the patient. Therefore, seroma is receiving more and more attention from clinicians. At present, prevention is still the main focus for reducing the occurrence of seroma after inguinal hernia repair, and various scholars have different opinions on the treatment of seroma that has already occurred.

1. Introduction

Inguinal hernia is one of the common diseases in general surgery, which refers to the protrusion of organs or tissues in the abdominal cavity away from their normal anatomical position and towards the body surface through a weak point or defect in the inguinal region, the incidence of this disease is 0.1%~0.5% [1], according to statistics, the number of patients with inguinal hernia can reach 3-5 million each year in China, currently surgery is the only treatment, and inguinal hernia surgery can reach 1.5 million cases each year Around [2-3], but there are postoperative complications such as seroma, pain, constipation, haematoma, urinary retention and surgical site infection, among which seroma is one of the common complications after inguinal hernia repair and can aggravate the postoperative pain of patients. This paper summarises the treatment of seroma by Chinese and Western medicine with a view to providing a better solution for the subsequent clinical treatment of seroma, and also providing more possible directions for subsequent clinical research, so as to find a better way to treat seroma and to reduce postoperative pain and discomfort in patients.

2. Seroma

2.1. Definitions

Seroma is seen not only after inguinal hernia surgery but also in other clinical conditions such as after modified radical surgery for breast cancer and after total body liposuction [4]. A seroma after

inguinal hernia repair is a fluid mass formed by an aseptic inflammatory reaction in the tissue spaces or underlying cavities formed after surgery, with the accumulation of exudates such as water, electrolytes, plasma proteins and neutrophils, mostly between the patch and the anterior abdominal wall [5-6].

2.2. Clinical presentation

The main clinical manifestations of a seroma are a prominent mass in the inguinal region that is hard, does not deform on pressure and cannot be returned to the abdominal cavity, which is difficult to distinguish from a recurrent hernia [4]. The prolonged duration of the seroma can cause displacement of the patch and increased pain, which can lead to extreme discomfort and anxiety, resulting in a severe psychological burden for the patient and, in severe cases, reoperation [6].

2.3. Typing

Seroma is classified into 5 types according to the Morales typology recommended by the European Hernia Society in 2012: Type 0, seroma without clinical symptoms (seroma confirmed by imaging, but asymptomatic). Type I, seroma occurring for ≤ 1 month. Type II, seroma lasting > 1 month. Type III, where the seroma is not absorbed by the body on its own, requires treatment and has minor complications. Type IV, with severe seroma complications [6]. The clinical significance is that seroma types I and II are simple events after inguinal hernia repair and seroma types III and IV are complications after inguinal hernia repair [4]. In clinical practice, seromas of types I and II are treated conservatively, while seromas of types III and IV are often treated by puncture aspiration.

3. Chinese and Western medical treatment

3.1. Chinese Medicine Treatment

The inguinal hernia belongs to the category of "hernia" in Chinese medicine. The earliest mention of the name "hernia" was in the Emperor's Classic of Internal Medicine [7] and in Su Wen - The Treatise on Long Thorns: "When the disease is in the lesser abdomen and the abdominal pain prevents urination and defecation, the name of the disease is hernia [8]". Chinese medicine mostly refers to inguinal hernia as "fox hernia". It is called "fox hernia" because the small intestine falls into the scrotum, sometimes up and sometimes down, and the swelling can retract into the abdominal cavity when lying down or pushing with the hand, and then fall into the scrotum when standing up, just like a fox's unpredictable entry and exit [1]. Post-operative complications of inguinal hernia repair such as haematoma belong to the category of "tendon injury" in Chinese medicine. According to Chinese medical theory, after trauma or surgical operation, the patient's local meridians and tendons are damaged, the blood vessels are blocked, the qi and blood flow is abnormal and overflows outside the veins and accumulates between the couples, which manifests as swelling and pain, as stated in the Yellow Emperor's Classic of Internal Medicine "qi hurts pain, form hurts swelling", therefore, its treatment should be based on activating blood circulation, removing blood stasis, eliminating swelling and relieving pain [9-10].

3.2. External application of Chinese herbs

The external treatment of Chinese medicine has been of interest to many clinicians since ancient times [11]. As early as the Shennong Ben Cao Jing, there are descriptions of the external treatment of Chinese medicine; in the Yellow Emperor's Classic of Internal Medicine, there are external

treatment methods such as dipping, hot bath and fumigation, and there are also ways of making ointments and their clinical application. In the treatise on the sources of medicine, there is a description that "the most important method of surgery is external treatment" [12], and Wu Shiji of the Qing dynasty proposed in his theory of parallelism that the external treatment method is "one is plucking and the other is cutting", stating that "where the disease is knotted, plucking will bring out the disease automatically, and there is no deep internal trap [13]. In the treatment of haematoma, the mangoes are used to treat the swelling. In the treatment of haematoma, mannitol and ice chips are ideal for external application [9].

3.2.1. Mancozeb

It has been recorded in Shennong Ben Cao Jing as early as 2,000 years ago [14]. According to Shennong Ben Cao Jing, "Mannitol is an effective external treatment for cold and heat, and can remove the accumulation of heat and cold in the six provinces, and can dissolve 72 kinds of stones [13]. "It is also used to remove the seventy-two kinds of stones. It can be used internally or externally to moisten and soften hardness and disperse knots, to facilitate the circulation of the bowels, to clear heat and remove fire and dampness, and to relieve swelling and pain. It can be applied externally to constrict local blood vessels and reduce congestion and swelling of surgical incisions [15]. It is used to treat the accumulation of heat in the five viscera and the closure of the stomach for a long period of time, to remove evil qi, to break up retained blood, to remove phlegm from the abdomen, to clear the meridians, to facilitate the flow of urine and stool and menstrual water, to break up the five lacunas, and to push the old into the new [13].

Based on this study, Li Qun et al. [15] investigated the efficacy of external application of mannitol in postoperative inguinal hernia seroma and found that it was effective in improving incisional healing and reducing the incidence of seroma in postoperative inguinal hernia patients. They analyzed that the external application of mannitol reduced the release of inflammatory factors and inhibited the proliferation of vascular endothelium, thus reducing the inflammatory response and the incidence of seroma. Zhong Zhenwu et al. [16] made homemade mannitol swelling bags to prevent the occurrence of postoperative seroma and also achieved good results, which demonstrated the effectiveness of mannitol as a topical Chinese medicine. Liu Xiaosheng et al. [17] used low-temperature mannitol sequential therapy (intraoperative saline rinse at 4 °C + postoperative inguinal ice for 2 h + postoperative mannitol topical application for 2 d) to investigate the efficacy on the occurrence of seroma, and found that it could also effectively prevent the occurrence of postoperative seroma, and could reduce postoperative pain and promote recovery.

Modern pharmacological studies have shown that mannitol, a sulphate mineral [18], whose main component is sodium sulphate, creates a hypertonic environment when applied topically to promote the absorption of exudate and inflammatory cells, allowing the inflammation to subside and to exert analgesic and anti-infective effects [15], and its anti-inflammatory mechanism has been found to be closely related to the production of prostaglandin E2 (PGE2) [14], so that subsequent studies can be conducted on the effect of PGE2 on seroma.

3.2.2. Mannitol combined with ice chips

Ice chips have a long history of medicinal use in China [10, 19-20]. They are pungent, bitter, slightly cold in nature, and belong to the heart, spleen and lung meridians, with the function of opening all orifices, dispersing depression and fire, removing cataracts and brightening eyes, reducing swelling and pain. This is related to the permeation-promoting effect of ice chips, which can facilitate the percutaneous absorption of other drugs [21]. Topical application of ice tablets can promote superficial vasoconstriction, reduce inflammatory exudation and the release of

inflammatory factors [17]. In a clinical study of mannitol combined with ice chips for the treatment of seroma, it was found to be effective in preventing the development of seroma [9]. This is similar to the above mentioned treatment of seroma with low temperature mannitol sequential therapy by Liu Xiaosheng et al.

3.2.3. Other externally applied herbs

According to the 2010 edition of the Chinese Pharmacopoeia and summarising previous experience in the use of medicines, in addition to the two externally applied medicines, mannitol and ice chips, there are also herbs such as calcined gypsum, neem, ocimum sanctum, wu bai zi, yanhu zuo, cinnamon, orange kernels and wu zhuyu, all of which have the potential to treat post-operative haematoma after inguinal hernia [22]. With the release of the 2020 edition of the Chinese Pharmacopoeia, herbs such as dahurica, angelica and safflower, which move Qi and blood, have also received attention, as well as volatile oils/volatile components including ice chips and fresh herbs, which can be used as a good transdermal absorption enhancer in topical preparations. Among them, fresh herbs are topical herbs made from whole or partial tissues of fresh plants or fresh animals or by taking their juice through processing, such as fresh burdock herb, fresh fengshen turbinata, etc. This is one of the topical features of TCM [11]. However, there are few clinical studies on these herbs for haematoma and further research is needed with a view to becoming a subsequent topical medicine for haematoma.

3.3. Internal use of Chinese medicine

3.3.1. Fangji Huangqi Tang

It is composed of four herbs, namely, Fang Ji, Huang Qi, Bai Zhu and Gan Cao, in the ratio of 4:5:3:2. In its usage, ginger and jujube are added to harmonize the Ying and Wei, and it is a representative formula to benefit Qi and promote water [23]. Its original discussion has two articles, which are found in "Jin Kui Yao Yao - Spasmodic Dampness and Hot Diseases with Pulse Treatment II": "For those with wind-dampness, floating pulse, heavy body, sweating and vicious wind, Fang Ji Huang Qi Tang is the mainstay." In the Jin Kui Yao Yao - Pulse Evidence and Treatment of Water-Qi, No. 14: "For wind-water, with floating pulse, heavy body, sweating and vicious wind, Fang Ji Huang Qi Tang is used. Add peony for abdominal pain." Zhang Zhongjing used Fangji Huangqi Tang to treat both wind-water and wind-damp conditions. At present, Fang Ji Huang Qi Tang is mostly used to treat diseases of the cardiovascular system, urinary system, bones and joints, and post-operative oedema, with remarkable clinical efficacy. In the treatment of post-operative oedema, it is widely recognised in the treatment of oedema of the upper limbs after breast cancer and is also effective in the treatment of swelling of the limbs after fracture of the lower limbs [24]. In the treatment of postoperative seroma after inguinal hernia, Fan Liuyang et al. [25] found that oral administration of Fangji Huangqi Tang could reduce the inflammatory response after inguinal hernia surgery and had a preventive and curative effect on seroma. In the treatment of postoperative inguinal hernia seroma in children, Zhai Xiaoyu et al. [26] found that oral administration of Fangqi Huangqi Tang was effective in improving the clinical symptoms of seroma in children, based on conventional treatments such as local pressure and hot compresses. Therefore, Fangqi Huangqi Tang is an effective oral Chinese medicine for the treatment of post-operative inguinal hernia haematoma.

3.3.2. Siwu Tang with added flavour

In addition to the conventional treatment after inguinal hernia repair (scrotal padding, sandbag

pressure, etc.), the formula of "Plus-flavoured Four-item Soup" was used orally, including San Qi 8 g, Yan Hu Suo 12 g, Angelica sinensis 10 g, Di Huang 12 g, Red Shao 12 g, Chuan Xiong 10 g, Fu Ling 12 g and Orange Kernel 6 g. Lai et al. found that "Plus-flavoured Four-item Soup" was clinically effective in the treatment of postoperative haematoma after inguinal hernia repair. This formula can effectively shorten the time for the hematoma to subside, and is worthy of promotion in clinical practice [27].

3.3.3. Clear Swelling and Dissipation Soup in combination with Mai Zhi Ling

Lian Jinming et al. [28] found that the combination of Qingxiang Dispersing Tang and Mai Zhiling was effective in promoting the absorption of seroma, reducing the incidence and size of seroma after inguinal hernia repair. The combination of all these herbs can play a role in clearing and dispersing the swelling, while Mai Zhi Ling has been used in the treatment of venous insufficiency [29-30]. The present study investigates the efficacy of Mai Zhi Ling in the treatment of seroma, which is mainly composed of horse chestnut seed extract. The active ingredient is hesperidin, which has the ability to reduce vascular permeability, increase venous reflux, reduce venous stasis, be anti-inflammatory and eliminate edema [31]. Studies have shown that this drug inhibits serum protease activity, protects the normal tissue and structure of veins, increases vascular elasticity and tone, reduces leakage of tissue fluid, increases venous return, and thereby eliminates oedema [10]. Hua Cong et al. [10] investigated the effect of topical application of Bing Nian San (ice chips and mannitol) combined with Mai Zhi Ling on the treatment of knee swelling after anterior cruciate ligament (ACL) reconstruction, and found that their combination was effective in improving knee swelling after ACL reconstruction, which provides ideas for the treatment of other postoperative swellings, such as those described in this paper. The treatment of seroma after inguinal hernia repair is expected to be followed up with this protocol for its clinical study.

3.4. Chinese herbal fumigation

The therapeutic effect of warmth can increase the permeability of blood vessel walls and cell membranes and accelerate local blood flow [32]. For post-operative inguinal hernia hematoma, the use of steep herbs such as mannitol, glycyrrhiza, petunia, and light powder can be used [1]. The rationale for this method may be that it promotes local blood circulation, thus acting as an anti-inflammatory and analgesic and facilitating the reduction of the hematoma. However, this method is less clinically studied and applied, which may be related to the unpopularity of fumigation apparatus in hospitals. Therefore, follow-up improvements are expected, such as simply fumigating the affected area with Chinese herbs instead of taking sitting fumigation, and in addition, the specific herbal fumigation drugs need further screening, which warrants further clinical research.

4. Western medical treatment

4.1. Clinical Operations

4.1.1. Placement of negative pressure drainage

Some believe that intraoperative placement of negative pressure drains is effective in preventing the development of seroma after inguinal hernia repair and does not produce retrograde infection; however, traditional surgical philosophy holds that inguinal hernia repair is a clean procedure and does not require the placement of drains, which would increase the chance of retrograde infection. Therefore, there is still controversy as to whether or not to place drains for inguinal hernia repair [33]. They found that the placement of negative pressure drains did reduce the incidence of

postoperative seroma, but conversely prolonged the duration of surgery, hospital stay and postoperative time in bed [34,35]. In a clinical study, they found that placing a negative pressure drain through a 5-mm intraoperative puncture hole did not increase patient trauma and significantly reduced the incidence of seroma, while the negative pressure drain promoted early collapse of the dead space, allowing early adhesion formation in the anterior peritoneal space and facilitating mesh fixation. Especially for TEP repairs with unfixed mesh, early adhesion formation prevents mesh displacement and reduces recurrence. Their study also confirmed that the placement of negative pressure drains did not increase the risk of postoperative infection. The adoption of standard surgical procedures, negative pressure closed suction drainage and postoperative care were effective in reducing the risk of infection. Therefore, they conclude that the placement of a drainage tube. Different scholars have different opinions and this is indeed controversial. My personal opinion is that it still depends on the patient's actual situation, for example, a patient with a large hernia sac, a long medical history and a lot of underlying disease may be considered for the placement of a negative pressure drainage tube. Of course, this is also related to the experience of the operator and is closely related to the delicate intraoperative manipulation. The aim of this article is to summarise the experience in the treatment of seroma and therefore not to dwell too much on the intraoperative delicacy in order to avoid the occurrence of postoperative seroma as much as possible.

4.1.2. Compression by hernia belt

Compression therapy is a routine treatment after inguinal hernia repair to promote wound healing and reduce the formation of seroma. In the early stages, some practitioners have used lap bands or sandbags to apply local compression after surgery, but the results were found to be unsatisfactory because the lap bands and sandbags could shift with the patient's position, thus failing to have a preventive effect. Dai Xianghua et al. [36] found that compared with lap belts and sandbags for local compression of the postoperative inguinal hernia area, a hernia belt is more practical, does not shift, is relatively fixed, is easy to use and can significantly reduce the incidence of postoperative seroma [4].

4.1.3. Puncture and aspiration

Fine needle aspiration is indicated in patients with more severe seroma, mostly for seroma type III and above [36]. Multiple punctures will be required if seroma persists after puncture. The puncture should be strictly disinfected to prevent secondary infection and the puncture should be reviewed at 6 months postoperatively to assess the efficacy of the puncture [37].

4.2. Drugs

4.2.1. Polyglucine injection

Polycinnamol injection, also known as 1% ethoxylated sclerosing alcohol, chemically known as polyoxyethylene lauryl ether, is a commonly used sclerosing agent in clinical practice. Polycinnamol has been widely used clinically as a foam sclerosing agent in the treatment of varicose veins in the lower limbs [38]. In recent years, it has also been found to be effective in liver cysts, renal cysts, thyroid cysts and haemangiomas [39-43]. Li Zhichao et al. [44] investigated the treatment of seroma with sclerosing agents based on the fact that seroma is similar to spermatic cyst or syringomyelia, and applied polyglucine injection under ultrasound guidance for the treatment of seroma type II and above, and found it to be effective in the treatment of seroma and to reduce postoperative pain in patients. The mechanism may be that the injection of polyglucine caused aseptic inflammation of the residual hernia wall or the seroma wall and subcapsular fascial tissues,

which in turn stimulated fibrous proliferation of the wall and subcapsular fascial tissues and healing. However, there are limitations in this study as the sample size was only 15 cases, therefore it is necessary to increase the sample size to further investigate the therapeutic effect of polyglucine injection on seroma, which is a novel research direction and provides an idea for other sclerotherapy for seroma.

4.2.2. Sodium hesperidin and glucocorticoids

Sodium hesperidin, a natural botanical, has many pharmacological effects such as anti-inflammatory, anti-edema, anti-oedema and improving blood circulation [45], which is widely used in the treatment of cerebral oedema, fracture oedema and other diseases [46-48], which can eliminate oedema by lowering the osmotic pressure. Glucocorticoids are steroids produced by the adrenal cortex bundle, which have the function of regulating the growth and development, metabolism and immunity of the body [49], which can reduce inflammation and edema [50], is the most widely used anti-inflammatory and immunosuppressive agent in clinical practice. Some studies have shown that sodium hesperidin or small doses of glucocorticoids are effective in the treatment of seroma, and they reduce the occurrence of seroma by reducing exudation, eliminating oedema, anti-inflammatory and improving microcirculation [33].

4.3. Millimeter waves

Millimeter wave (millimeter wave) is a kind of electromagnetic wave, its frequency band is not too precise definition, usually the wavelength of 1 ~ 10 mm, the frequency of 30 ~ 300 GHz electromagnetic wave is called millimeter wave, it is located in the wavelength range of microwave and far infrared wave overlap, both the characteristics of the two wave spectrum, the wavelength of the commonly used clinical treatment instrument is 8mm, the frequency of 37.5 GHz. Millimeter wave is a series of non-thermal biological effects caused by electromagnetic radiation to regulate cell metabolism, accelerate the repair of damaged tissues, effectively enhance microcirculation, improve blood perfusion, reduce edema in the operating area and relieve pain [51-52]. It has been used in the treatment of rheumatoid arthritis, knee pain, low back pain, headache and other painful conditions [52-55]. Li Peixin et al. [51] found that millimeter waves can effectively reduce the incidence of postoperative inguinal hernia seroma, which is also an effective method for the prevention and treatment of postoperative inguinal hernia seroma and is worthy of clinical promotion.

5. Conclusion and outlook

Overall, the formation of seroma after inguinal hernia repair is closely related to the aseptic inflammatory response in the postoperative region, and therefore it may not be completely avoidable, but the vast majority of seromas have their own limitations and therefore prevention is the mainstay to reduce their occurrence, such as postoperative treatment with local compression and millimetre waves, etc.; postoperative changes are closely monitored and treated promptly when they occur. For types I and II seroma, conservative treatment is often used, with the application of oral or topical Chinese herbal medicine and, if available, the addition of fumigation. For types III and IV seroma, conservative treatment may not completely eliminate the seroma, so puncture and aspiration may be added, or intraoperative negative pressure drainage tubes may be placed to prevent the formation of postoperative seroma according to the patient's physical condition and the physician's experience. In the treatment of seroma, Chinese medicine and Western medicine have their own indications, but in my opinion, Chinese medicine has its own advantages, for example,

the use of external application of Chinese herbal medicine with mannitol and ice chips has been widely used in clinical practice, but in recent years there has been a lack of clinical studies on the application of other external herbal medicines. In addition, for the treatment of seroma, I have not seen a clinical combination of Chinese and Western medicine to treat seroma, and I believe that this can be tried clinically, for example, using a hernia belt combined with external application of Chinese herbs, together with protocols such as polyglactin injection, oral Western medicine or millimetre wave physiotherapy.

The aim of this literature is to summarise past treatment experiences and provide ideas for future research, in the hope that more clinicians will then find more effective ways to treat seroma, to reduce postoperative pain and discomfort, to reduce patient anxiety and to provide a better quality of life for patients after inguinal hernia repair.

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