

The Effects of Absorbable Materials in the Treatment for Non-Weight-Bearing Bone Fractures of Extremities

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Abstract: *Objective:* To study the effects of absorbable materials in non-weight-bearing bone fractures of extremities. *Methods:* After 66 patients with non-weight-bearing bone fractures of extremities were selected, absorbable materials were used in the observation group and metal materials were used in the control group. *Results:* After treatment, the bone healing in the observation group was significantly improved ($P < 0.05$). *Conclusion:* the application of absorbable materials in non-weight-bearing bone fractures of extremities is effective.

Keywords: Absorbable material; Non-weight-bearing bone fracture of extremities; Effect

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Belonging to orthopedic diseases, bone fractures of extremities are common in clinic. Anatomical reduction is generally used to effectively treat patients with this disease. During the operation, the metal material is used for internal fixation, so as to fix the fracture correspondingly, and then the fixation is taken out after the bone heals. This is also surgical treatment, but the patient's pain doubled due to two operations. Meanwhile, the use of metal materials can lead to a variety of allergic reactions^[1], result the infection of the patient. Therefore, clinical analysis has been made accordingly, and absorbable materials have been proposed, which can effectively solve the problems of secondary surgery and allergy, and decompose absorbable materials to be degraded and absorbed by the body. This material belongs to a novel artificial synthetic material, has excellent biocompatibility, does not stimulate patient tissues, does not need to

betaken it out by secondary surgery, and is a common fracture fixation material. In this group, 66 patients were selected to analyze the effect of the application of absorbable materials in non-weight-bearing bone fractures of extremities.

1 Data&Methods

1.1 Data

From May 207 to April 2018, 66 patients with non-weight-bearing bone fractures of extremities diagnosed and treated in our hospital were selected. They were informed into the group and divided into groups by drawing lots. The data of the observation group were 33 cases, including 20 males, aged between 20 and 65 years old, with a median age of 35.5 years old. The data of the control group were 33 cases, including 21 males, aged between 21 and 66 years old, with a median age of 35.0 years old. The data of patients in the two groups were similar, by t test or χ^2 test, $P > 0.05$.

1.2 Methods

The observation group applied absorbable materials with D IKFIX absorbable screws produced by Chengdu Dikang Zhongke Biomedical Materials Company. Before the reduction and fixation treatment is carried out, drugs are used to stabilize the injured limb of the patient and detumescence treatment is carried out. Before the operation, reasonable anesthesia is carried out for the patient and hemostasis is carried out routinely for the patient. The surgical incision site is reasonably selected. The exposed fracture is separated layer by layer. Blood clots are cleaned and broken soft tissues are reduced to ensure accurate reduction according to the actual situation of the fracture of the patient. In the clinical fixation process, fine Kirschner

wires and towel clamps are used to complete the operation. After the patient's condition is confirmed by intraoperative fluoroscopy, the wound is sutured with absorbable screws for reasonable fixation.

The control group was treated with metal material, and the rest of the operation was the same as above. When it fixes reasonably, the metal bone nail was used.

After the completion of the operation, the patients in the two groups need to be fixed with plaster for 4 to 6 weeks, and the control group needs to complete the second operation within 10 to 15 months after operation.

1.3 Effect analysis^[2]

After treatment, X-ray films were taken for the patient. The fracture was restored accurately and completely healed. After follow-up for 6 months, the patient's joints were free to move and there was no pain in the wound, which was completely healed. After the wound was healed for a long time and was followed up for 12 months after operation, the patient took the X-ray

film. As the delayed healing, the fracture was restored accurately and the joints moved freely without any pain at the wound; as for other cases, they are not healed.

1.4 Statistical methods

Overall analysis of patient measurement data (t test), counting data (χ^2 test), statistical software package according to the SPSS 20.0, (mean \pm standard deviation), rate is the form of expression, $P < 0.05$, for which, there is statistical significance.

2 Results

After treatment, compared with the control group, bone healing in the observation group improved significantly ($P < 0.05$). The wound healing, hospitalization time and follow-up of the two groups were compared ($P > 0.05$). In this study, bone of all patients was properly healed without fracture displacement and nail breakage. From the result of X-ray film, the normal joint function of the patient was basically restored operation.

Table 1. Comparison of recovery time in two groups (weeks)

Group	Bony healing	Wound healing	Hospitalization
The observation group	10.1 \pm 1.3	2.1 \pm 1.7	3.1 \pm 1.4
The control group	12.1 \pm 0.7	2.2 \pm 1.2	3.2 \pm 1.6
<i>t</i>	7.7814	0.2760	0.2702
<i>P</i>	<0.05	>0.05	>0.05

Table 2. Comparison of follow-up between the two groups (%)

Group	Complete healing	Delayed healing	Nonunion
The observation group	30 (90.90)	3 (9.09)	0 (0.00)
The control group	27 (81.81)	6 (18.18)	0 (0.00)
χ^2	1.1579	1.1579	-
<i>P</i>	>0.05	>0.05	-

3 Discussion

Clinically, it is very common for patients with non-weight bearing bone fractures of extremities. After the onset of the disease, the daily life of the patients will be seriously affected. In the treatment process, corresponding work should be done to ensure accurate reduction of the patients. Reasonable fixation of the fracture after reduction can avoid displacement or loosening of the fracture of the patients. This process is very important. In the process of selecting solid materials, the operator should be careful, because

this measure is also very important. At present, metal materials are mainly used for internal fixation of fracture sites clinically, and secondary surgery is carried out for patients after the patients are completely healed^[3], which aggravates the pain degree of patients, so the metal fixation materials need to be taken out; Clinical practice has proved that metal materials can be used to fix the fracture of patients with non-weight bearing bone fractures of extremities, and the expected therapeutic effect can be achieved. However, because the fixing material is metal, it will stimulate the patient's tissues and lead to allergic reactions such as inflammation

and infection. It is also necessary to provide the patient with a second operation, which will lead to the patient's secondary pain and lead to a greatly prolonged bone healing time. However, the use of absorbable materials is safe and feasible. As a novel material, it has good biocompatibility with human bodies, and can be degraded into carbon dioxide and water^[4], it does not cause stimulation to the tissue structure of the affected part of the patient, and will not affect the normal physiological metabolism of the patient, so that the bearing capacity can gradually disappear; after the fracture of the patient is completely healed, the absorbable fixing material is completely degraded, the mechanical property can completely disappear, and no stress shielding effect can be generated. Therefore, for patients with non-weight-bearing bone fractures of extremities, absorbable fixation materials are used to control the degradation speed well^[5], so that the degradation does not occur before the bone is completely healed, the patients will not lose biomechanical ability quickly, and the patients can obtain fracture healing treatment effect; with this new material, the patient does not have allergy, does not need to take secondary surgery, does not need to remove the fixture, and he avoid the patient to have two times of pain. Clinical analysis of the applicable scope of absorbable screws shows that the absorbable screws are suitable for non-load bearing fractures and cancellous bone fractures, including elbow of upper limb, greater tuberosity of humerus, wrist fracture, femoral head partial fracture of lower limb, acetabular fracture, femoral ankle fracture, medial and lateral malleolus fracture, etc. These parts are mainly cancellous bone, and most patients belong to intra-articular fractures. After fracture fixation treatment, patients do not need to carry out secondary surgery, which can avoid joint stiffness and joint adhesion again. The complete degradation time is 12 to 18 months, thus ensuring the fixation time. The clinical analysis of the characteristics of absorbable screws can avoid secondary operations, so as to significantly shorten the hospitalization expenses and duration of patients. It also has good biocompatibility to ensure adequate strength for fixation. The micro-movement for bone tissue is beneficial to fracture healing. In the early stage, it can ensure that the strength required for fracture end fixation is sufficient. Its strength is higher than cancellous bone strength with 10 to 20 times. The firm, reliable and safe. Stability, firmness and safety can be

gradually decreased with the fracture healing strength of patients, for which, fracture healing is synchronized, so it can prevent osteoporosis after metal fixation material healing because there is no stress shielding. Because the absorbable screw is a biomedical polymer material, the final hydrolysate can be completely absorbed by the human body and excluded from the body. Within 48 hours, the hydrolysate can expand itself, which can effectively enhance the firmness, and maintain the fixation strength about 6 months. It will not interfere with the postoperative imaging examination, and nor will it affect the future revision surgery.

Clinical practice has proved that the use of absorbable materials in the treatment of patients with non-weight-bearing bone fractures of extremities is highly feasible, the postoperative bone healing of patients is good, and there is no phenomenon such as fracture displacement and nail breakage. X-ray film after the operation showed that the fracture of the patient basically recovered and the joint function of the patient was restored^[6]; The reason for this is that the absorbable material is absorbed by the human body and has good biocompatibility. It can avoid metal stimulation of patient tissues, obviously shorten the wound healing time of patients, shorten the hospitalization time and bone healing time of patients at the same time, and will not cause allergic reactions of patients. In addition, the patient avoids secondary surgery^[7-8], avoids the pain of removing the fixing material, which can obviously reduce the incidence rate of postoperative complications and postoperative infection rate of the patient, and can save the operation cost of the patient to a certain extent. Therefore, the use of absorbable materials has obvious clinical advantages. Clinical analysis: Deficiencies and precautions of absorbable materials in non-weight-bearing bone fractures of limbs. Because absorbable screws are easy to break, when screwing in the screw cap during the operation, they are easy to break and the screw cap has a small torsional resistance. Therefore, strict tapping should be carried out to ensure that the drilling and tapping directions are consistent, so as to strive for one-time success, avoid aggravating local fracture degree and repeated damage, and increase the fixing difficulty. After the operation, the patient should be given to the firm brake. Within a week, the patient should avoid excessive muscle activity. Strong joint activity can lead to fracture of the screw, resulting the necessity for re-operation. Due to small shear resistance of absorbable

screws, strong external fixation is required in the near joint and the parts with a large range of motion, such as the elbow joint, which may lead to joint stiffness and muscle atrophy of patients. In clavicle and in the uncertain part of external fixation after operation, absorbable screws are not recommended for fracture fixation. Due to gravity and local muscle contraction, fracture displacement may occur.

In addition, clinical studies have found that the release of degradation products can lead to local tissue reactions. If degradation products exceed the removal ability of the patient's tissue cells, reactions of obvious inflammatory foreign body can occur. At this time, the patient's surgical wound healing is the delayed allergic reactions. The occurrence rate of this inflammatory reaction is lower in areas with high metabolism and abundant blood supply, and it is higher in areas with poor blood supply.

The experimental results showed that the bone healing in the observation group was significantly improved; the wound healing, hospital stay and follow-up in the two groups were compared ($P>0.05$). Clinical practice has proved that internal fixation with absorbable materials is a recommended clinical use and a clinical trend.

Based on the above data and conclusions, it is concluded that it is worthy of clinical recommendation, because the effect of absorbable material in non-weight-bearing bone fracture of extremities is ideal, which can significantly reduce the time of bone healing and promote the recovery of the disease as soon as possible. During the follow-up study, the sample selection amount should be appropriately increased, the sample selection time should be prolonged, and the absorbable materials should be analyzed accordingly,

so as to increase the clinical significance of this group of experiments and improve the therapeutic effect of patients with this disease.

References

- [1] Feng JD. Treatment of Long Bone Fractures of Extremities with Interlocking Intramedullary Nail[J]. Henan Medical Research, 2019, 28(17).
- [2] Zhou CQ, Xi ZR, Mao JG, et al. The comparison of Therapeutic Effects of Kirschner Wire, Miniature Steel Plate and Absorbable Internal Fixation Materials on Proximal and Middle Phalangeal Fractures[J]. Chinese Journal of Hand Surgery, 2018, 34(2): 106-107.
- [3] Cheng ZD, Chang XD, Wang HZ, et al. Clinical Observation of Two Different Internal Fixation Materials in the Treatment of Tibial Avulsion Fracture of Anterior Cruciate Ligament in Children[J]. Gansu Medicine, 2018 (3): 242-244.
- [4] Hu DY. Clinical Effect of Small Incision Protective Lateral Calcaneal Bone Flap Absorbable Nail in the Treatment of Calcaneal Fracture[J]. Chinese and Foreign Medical Research, 2019, 17 (25): 46-48.
- [5] Lu K, Yang RT, Zhou HH, et al. Application of Absorbable Nail board in Maxillary and Whole Facial Fractures[J]. Chinese Journal of Practical Stomatology, 2019, 012(006): 332-335.
- [6] Yang L. Clinical Observation on Treatment of Avulsion Fracture of Great Tubercle of Humerus with Absorbable Screw[J]. Chinese Journal of Practical Rural Physicians, 2011, 26 (04): 57-59.
- [7] Dong XM, Gao WY. The comparison of the Effects of Absorbable Screws and Self-Enhanced Absorbable Rods in the Treatment of Hand and Foot Fractures[J]. Journal of Mathematical Medicine and Pharmacy, 2019, 032 (006): 819-820.
- [8] Feng W, Wang Q, Song BJ, et al. Using the Fixation of Kirschner Wire Absorbable Suture Tension Band to Treat the Ulnar Olecranon Fracture in Children[J]. Journal of Clinical