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OPTIMIZATION OF REMOVAL OF X-RAY VISUALIZED FOREIGN BODIES OF SOFT TISSUES

DOI 10.25789/YMJ.2020.69.28

УДК 616-003.6-073.75-089

Aim. To improve the results of removal of x-ray visualized foreign bodies of soft tissues.

Material and methods. The data of treatment of 135 patients with x-ray visualized foreign bodies of soft tissues in the department of purulent surgery of the 301 military clinical hospital of Khabarovsk from 1987 to 2013 was analyzed.

Results. The use of a set of measures to remove x-ray visualized foreign bodies, including the use of copper mesh and marking with an indelible marker on the skin of the projection of the foreign body and the direction of the incision proves statistically significant ($p<0.05$) diminishment the frequency of repeated operations to remove foreign bodies from 29.3% to 0%, the time of surgical intervention during the first operation from 45.8±0.8 minutes in patients of the control group – up to 20.6±0.3 minutes in patients of the main group, as well as the frequency of suppuration of the surgical wound from 7.3% to 0%, respectively.

Conclusions. Surgical intervention to remove x-ray visualized foreign bodies from soft tissues should be carried out taking into account the indications and contraindications to the operation, use optimal anesthesia depending on the specific situation after the mandatory x-ray and ultrasound examination, with the mandatory use of copper mesh and marking with an indelible marker on the skin of the projection of the foreign body and the direction of the incision.

Key words: x-ray visualized foreign bodies, soft tissues, treatment.

Introduction. The choice of treatment strategy of patients with foreign bodies of soft tissues is a very difficult problem due to the wide incidence of this pathology [3, 5, 12]. For example, in 12-38% of patients traumatic injuries are complicated by various foreign bodies entering the wound. [2,11]. Some patients consciously introduce various foreign bodies into the soft tissue [1,15,13].

Removal of small and deep-located foreign bodies of soft tissues is particularly difficult and unsuccessful attempts are observed in 12.5–30% of cases [5,12]. In order to clarify the localization of foreign bodies such methods as ultrasound and computer tomography are used. Meanwhile, despite of preoperative examination, the search of a foreign bodies of soft tissue during surgery often takes a lot of time, leads to extensive tissue damage and also increases the risk of complications [12,14].

The **aim** of this work is to optimize the methods of diagnosis and removal of x-ray contrast foreign bodies of soft tissues.

Research Material and Methods. The analysis of treatment of 135 patients with x-ray contrast foreign bodies of soft tissues and had been hospitalized to the department of purulent surgery of the 301 Military clinical hospital of Khabarovsk from 1987 to 2013 was carried out.

Among these patients 29 (22%) have introduced various foreign bodies into the soft tissue consciously.

The traditional method of diagnosis of x-ray contrast foreign bodies of soft tissues was used from 1985 to 2001 in 82 (60,7%) patients of the control group.

For the period from 2002 to 2018 the diagnosis of x-ray contrast foreign bodies of soft tissues was based on the application in addition to x-ray examination such methods as ultrasound and use of copper mesh with subsequent marking of projection of a foreign body and operative access on skin [7].

The age of patients ranged from 16 to 55 years, average age was 25,9±3,2 years in the main group and 23,7±2,6 years in the control group. In both groups there were 132 men (97,8%) and 3 women (2,2%).

According to the terms of finding foreign bodies in soft tissues at the time of hospitalization, patients were distributed as follows: The 77(57%) patients were hospitalized within the first 7 days after injury, 22(16.3%) patients – from 7 days to 1 month after injury, 15(11.1%) patients – from 1 month to 6 months after injury, 9(6.7%) patients – from 6 months to a year after injury, 12(8.9%) patients – a year or more from the date of injury.

The main and control groups were the same in sex and age of patients, duration of the disease, which allowed to compare the results (Table 1-3).

Results. The number of operations, which were performed in order to remove foreign bodies, are presented in Table 4.

In 5 (6.1%) patients of the control group, foreign bodies, despite repeated operations, were not removed.

The duration of the first operation in patients of the main group averaged 20.6 ± 0.3 minutes, in patients of the control group - 45.8 ± 0.8 minutes, the difference in performance was statistically significant ($p <0.05$).).

In 6 (7.3%) patients in the control group were diagnosed with postoperative wound suppuration, which is connected, in our opinion, with the duration of the operation and tissue trauma, while in the main group of patients there was no such complication.

Discussion. There are known methods for removing X-ray contrast

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Table 1

The types of x-ray contrast foreign bodies, (n=135)

Вид инородного тела	Foreign body (abs., %)	
	unintentionally inserted	deliberately inserted
Sewing needle	18 (17)	28 (96.6)
Needle for injection	3 (2.8)	0
Surgical needle	3 (2.8)	0
Metal splinters	35 (33)	0
Metal shards	5 (4.7)	0
Metal bullet	22 (20.8)	0
Fragments of metal structures	6 (5.7)	0
Glass	5 (4.7)	0
Wire	9 (8.5)	1 (3.4)
Total	106	29

Table 2

Localization of foreign bodies of soft tissues in patients (n=135)

Localization of foreign body	Foreign body (abs., %)	
	Unintentionally inserted	Deliberately inserted
Hand	29 (27.4)	-
Gluteal region	10 (9.4)	-
Thigh	16 (15.1)	1(3.4)
Shin	4 (3.8)	28 (96.6)
Foot	40 (37.7)	-
Other areas	7 (6.6)	-
Total	106 (100)	29 (100)

Table 3

The nature of the inflammatory process in the area of localization of foreign bodies of soft tissues in patients (n=135)

The nature of the inflammatory process	Foreign body (abs., %)	
	Unintentionally inserted	Deliberately e inserted (abs., %)
No clinically significant inflammation	72 (67.9)	9 (31)
Inflammatory infiltrate	26 (24.5)	8 (27.6)
Abscess	6 (5.7)	4 (13.8)
Phlegmon	2 (1.9)	8 (27.6)
Total	106 (100)	29 (100)

Table 4

The distribution of patients depending on the number of operations performed when removing foreign bodies of soft tissues

The number of operations performed per patient	Patient group (abs., %)	
	Main group	Control group
1	53 (100)	58 (70.8)
2	0	17 (20.7)
3-5	0	6 (7.3)
More than 5 operations	0	1 (1.2)

foreign bodies from soft tissues, involving the use of various search probes using magnets for the intraoperative search and removal of a foreign body [4, 6, 8, 9, 10]. These devices have the following disadvantages. First, the real magnetic environment of the operating room, created by metallic surgical instruments and equipment, reduces the possibilities of using these devices, reducing their sensitivity, and contributing to the appearance of false signals. Secondly, they have low sensitivity in relation to small foreign bodies. Thirdly, when the various search probes proposed by the authors work, the light and sound alarms can only determine the approximate location of the foreign body, which is usually clear after the preoperative examination. Finally, free capture of a small foreign body in the depth of tissues, for example, using the tool proposed by the authors [10], is impossible in the case of an encapsulated foreign body, since its separation from the capsule formed around it is required. There is also a danger of fragmentation and leaving a part of the foreign body in the wound.

A known method of removing a foreign body of human soft tissues [3], which consists in determining the X-ray projection of a foreign body on the skin using a metal grid, followed by performing an incision in the intended square. However, this method of removing a foreign body has several disadvantages that reduce its effectiveness. First, after a preoperative examination using a metal grid, the projection of a foreign body and the line of operative access with an indelible marker are not applied to the skin. Secondly, the implementation of surgical intervention begins with a fixed mesh, which does not allow for adequate access, as the mesh itself interferes with the manipulation of the wound.

In addition, in order to improve the efficiency of removal of foreign bodies of soft tissues, it is necessary to take into account the indications and contraindications for the operation, use the entire arsenal to improve the determination of the exact localization of foreign bodies, and also choose the best method of anesthesia.

The main indications for the removal of radiopaque foreign bodies are, in our opinion, dysfunction of the limb caused by a foreign body, chronic pain syndrome due to the presence of a foreign body in soft tissues, inflammatory changes in soft tissues or fistulas supported by a foreign body.

In addition to well-known contraindications to any surgery associated with high surgical and anesthetic risks, we consider that such contraindications as localization of foreign bodies in the immediate vicinity of major vessels, nerves and vital organs with a high risk of intraoperative injury, significant depth of the location of foreign bodies with small sizes and the absence

of clinical manifestations, as well as the surgeon's lack of sufficient experience for these operations are also considerable.

In order to more accurately localize radiopaque foreign bodies of soft tissues, it is necessary to use all possible methods, including X-ray and ultrasound examination, the use of a copper mesh and the projection of the foreign body itself on the skin and the most rational prompt access directions.

The choice of type of anesthesia is carried out taking into account the size, location, depth of the foreign body, as well as the age of the patient. In the absence of well-known contraindications to local anesthesia, this type of anesthesia can be used for superficial localization of foreign bodies (no deeper than 3-4 cm from the skin surface within the subcutaneous tissue or directly under the fascia) or if the foreign bodies are large, palpable, and no technical difficulties are foreseen in their removal. It is advisable to use general anesthesia for deep localization (more than 4 cm from the skin surface) of small foreign bodies adjacent to anatomically important formations. Before performing anesthesia, it is desirable to temporarily reduce blood flow in the operated limb segment by applying an arterial cord, which facilitates the search for a foreign body.

A common mistake, often leading to an unsuccessful attempt to remove a foreign body, should be considered a refusal to involve a second surgeon in the assistance, who provides a complete visualization of the surgical wound during the operation.

The search for foreign bodies of soft tissues in the overwhelming majority of cases, even after preliminary marking, is associated with significant difficulties. In this regard, while searching for foreign bodies it is recommended to use a number of the following techniques. Thus, during the revision of the wound, one should pay attention to the state of the tissues in the intended zone of foreign body localization. Approximate topical diagnostics of a foreign body in soft tissues is often carried out by black-brown staining of tissues, which indicates a close localization of the desired object. Initially, accurate probing of tissues with a closed Billroth-type hemostatic clamp is used with continuous visual inspection until a feeling of "scratching" appears. However, while removing foreign bodies from areas with multiple connective tissue webs, for example, palms or soles, the described sensations can be difficult to differentiate. A delicate examination of the wound with a finger, during which it is possible to palpate a foreign body, can be of great help in the search. However, the surgeon should be extremely careful in the presence of a piercing or cutting foreign body in soft tissues.

When a foreign body is detected, the main task is to remove it entirely, without leaving fragments. Anatomical tweezers are used for removal, which, unlike a clamp, allows precise gripping and avoiding foreign body fragmentation.

After successful removal of a foreign body and provided there are no signs of surgical infection of the soft tissues, the wound is stitched. The decision on the need for wound drainage and antibiotic therapy is taken individually.

In the postoperative period, control radiography is performed to eliminate accidentally left foreign body fragments.

Conclusions

1. Diagnostics of radiopaque foreign bodies of soft tissues should be based on the mandatory use of a complex of non-invasive methods, including X-ray and ultrasound examination, the use of a copper mesh and marking with a permanent marker on the skin of the projection of the foreign body itself and the direction of the incision.

2. X-ray contrast foreign bodies of soft tissues are accompanied by clinically significant inflammatory processes in 40% of cases.

3. Radiopaque foreign bodies which are deliberately inserted into soft tissues are usually sewing needles and are usually localized deep in the tissues of the posterior surface of the left tibia.

4. In our practice the usage of a set of measures to improve the localization of radiopaque foreign bodies of soft tissues and the usage of the above described features of their removal allowed statistically significantly ($p < 0.05$) reduce the frequency of repeated operations to remove foreign bodies from 29.3% to 0%, the time of surgical intervention for conducting the first operation from 45.8 ± 0.8 minutes in patients of the control group up to 20.6 ± 0.3 minutes in patients of the main group, as well as the incidence of suppuration of the surgical wound from 7.3% to 0%, respectively.

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