VIDEOASSISTED THORACOSCOPIC FIXATION OF FLOATING RIB FRACTURES

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Abstract. We examined the results of videoassisted thoracoscopic fixation of floating rib fractures in 16 patients with blunt chest traumas. The method, which was used, was described by K.G. Zhestkov and improved by the authors of this article. Indications for ribs fixation were prolapse of ribs fragments into the pleural cavity with the lung injury (7 patients) and functionally significant abnormal mobility of multiple rib fractures (9 patients). It is shown that the proposed method of videoassisted thoracoscopic ribs fixation at pathological mobility can reliably stabilize the chest wall without wide dissection of injured soft tissue.

Keywords: chest injury, fractured ribs, abnormal mobility, videothoracoscopy.

In recent years there has been a significant increase in road accidents, that defines the appearance of a large number of patients with severe traumatic injuries in general and injuries of the chest, in particular. In peacetime injuries of the chest are the third most common, and blunt chest trauma account for up to 90 % of cases (Vagner, 1981; Wanek and Mayberry, 2004).

Despite improvements in diagnostic techniques, infusion-transfusion therapy, modern methods of mechanical ventilation, mortality in presence of severe injuries to the chest reaches 35-45 %, and with concomitant injury chest, accompanied by shock, reaches to 63-68 % (Korotkov, Kutirev and Kukushkin, 2006; Ahmed and Jones, 2004).

The leading role in the development of complications and deaths in case of blunt chest trauma belongs to severe progressive respiratory disorders. One of the causes of such condition is a violation of the integrity of the rib frame associated with broken ribs. The frequency of rib fractures at patients with a closed chest trauma varies from 35 to 92 %, and deaths from injuries to the chest with a floating rib fractures are occured in 52,1-63,6 % of cases (Zhestkov, Barskiy and Voskresenskiy, 2006; Korotkov, Kutirev and Kukushkin, 2006; Moore et al., 2011; Wilson et al., 2009). Therefore the search for ways to reduce disordered breathing is an important part of pathogenetic therapy at these patients.

Existing methods of stabilization the floating rib fractures (fixation of bone fragments surgically and "internal pneumatic" stabilization by a prolonged mechanical ventilation (AV / 1) with positive expiratory pressure) do not fully satisfy clinicians, as they are related with a lot of inflammatory complications of breast tissue during surgical stabilization, and at artificial lung ventilation – broncho-pulmonary and intrapleural complications. All this makes it necessary to find other approaches (Zhestkov, Barskiy and Voskresenskiy, 2006; Korotkov, Kutirev and Kukushkin, 2006).

So, that’s why methods of fixation of floating rib fractures performed during videoassisted thoracoscopic procedures.

Material and Methods

Videoassisted thoracoscopic intervention sat blunt chest traumas in the 2nd clinic of the Tashkent Medical Academy are applied since 2006. Among patients with blunt chest injury indications for its implementation are determined at 146. Frequently blunt chest trauma is occurred at men – 102 (69,9 %). The age of patients ranged from 16 to 82 years (mean age 37,8 ± 1,5 years). The most common injury was transport – in 69 (47.3 %) patients, then household injuries – in 58 cases (39.7 %). 68 % of the patients were taken to the hospital through the emergency room, 32 % of the patients came themselves. Mainly patients were delivered during the first six hours after the trauma, although there have been cases of late treatment: for example, 9.7 % of patients were hospitalized a day after the injury.

Traumatic injuries of the chest from the right and left sides were occurred at approximately the same rate (respectively 48 and 52%), 12 % of damages were bilateral.
Blunt chest injury were combined with cranial trauma in 85 (58.2 %) cases, with fractures of the long bones – in 38 (26.0 %), pelvic bones – in 19 (13.0 %), injuries of the abdominal cavity – 28 (19.2 %), retroperitoneal space – in 23 (15.8 %).

In a state close to satisfactory, we received 57 (39.0 %) patients, moderate – 65 (44.5 %), in heavy – 25 (17.1 %).

On the basis of X-ray investigation hemothorax was detected in 30 (20.5 %) patients, pneumothorax – in 24 (16.4%), hemopneumothorax – in 91 (62.3 %).

Rib fractures were observed in 91 (62.3 %) patients: single rib fracture was observed in 66 (45.2 %), multiple – in 80 (54.8 %), including the formation of the rib valve – 9 (6, 2 %).

The indications for videoassisted thoracoscopic with closed chest trauma were medium and large (with late treatment of the patient) hemotorax, hemopneumotorax, unresolved pneumotorax, clotted hemotorax. Videotoracoscopy was not been performed in case of hemodynamic instability, reliable signs of the tracheal and large bronchi rupture, as well as the previous thoracotomy on the affected side.

Videotoracoscopy was carried out usually under anesthesia with separate tracheal intubation. Detectable traumatic injuries requiring surgical correction were eliminated with the videoassisted thoracoscopic.

So, videoassisted thoracoscopic stop of bleeding from intermuscular vessels and parietal pleura was performed in 75 (51.4 %) patients, bone fragments of ribs – in 43 (29.5 %), from the intercostal artery – in 12 (8.2 %) , suturing of ruptures of lung tissue – in 13 (8.9 %), electrocoagulation of ruptures – in 19 (13.0 %), suturing of bull – in 2 (1.4 %), the elimination of coagulated hemotorax – 11 (7 %).

It should be noted that all these interventions were often performed in patients with a blunt chest trauma with broken ribs, especially with multiple. Typically, in such cases, there was marked a rupture of the parietal pleura at rib fracture site, which became a source of intrapleural bleeding. In 7 patients with prolapse of bone fragment into the pleural cavity, there was a necessity to fix the ribs.

In these cases and in 9 patients with functionally significant floating ribs during videoassisted thoracoscopic intervention was made a fixation of them.

Criteria for fixing the ribs were the following: involving in the act of breathing of skeletal muscles (superficial muscles of the chest and neck), respiratory rate more than 30 in 1 minute, PaCO$_2$ – more than 40 mm Hg, PaO$_2$ – less than 92 % in 30-40 minutes after intramuscular administration of analgesics and local anesthetics. It should be noted that the expressed respiratory insufficiency (Breath rate more than 35, PaCO$_2$ – more than 50 mm Hg, PaO$_2$ – less than 90 %) were indication for pneumatic fixation during mechanical ventilation. As a rule, the latter was observed in bilateral fractures of the ribs withfloation of the sternum.

Fixation of ribs was carried by the method, which was described by Zhestkov K.G. and improved by us. During a thoracoscopy there was made an external finger pressure on the chest to determine the most mobile segments of floating ribs or fragments, perforating parietal pleura. To carry out the fixing material (absorbable suture material "Vicryl 0") under the front and backstable segments and on both sides of the floating ribs segment was used Fur needle. Then we performed a small skin incision over the site of the stable edges in 3-4 cm from the fracture and through this incision subfascially to the fracture line summed spoke. With the help of sup rimposed suture material we pulled up with a view to reposition the floating segment. Spoke was carried o t along the floating segment to another stable segment of the rib. After this we tightened pre-imposed pericostal seams, fixing stable segments and the floating segment to the spoke. In the same manner we fixed the remaining edges.

It should be noted that patients with broken ribs for the purpose to relief pain intraoperatively under controlled videotoracoscopy we introduced catheters for postoperative novocaine blockade into intramuscular subfascial space.

All 16 patients videoassisted thoracoscopic fixation has eliminated paradoxical movement, as well as stabilized the rib.

8 (50 %) patients were extubated in the first day, 3 (18.8 %) – on the second, 2 (12.5 %) – in the third, 3 (18.8 %) patients due to the severity of associated trauma mechanic ventilation was conducted for 11-13 days.

Lethal outcome occurred in 2 (12.5 %) patients due to the increase of respiratory failure associated with a massive injury of the lung tissue and progression of cerebral coma due to a brain injury.

In 2 (12.5 %) patients in the postoperative period after the imposition of the spokes was marked suppuration of intramuscular hematoma. In the remaining patients the postoperative period was uneventful.
The duration of hospital stay ranged from 8 to 22 days. Spokes were removed on the 30-40th day in the outpatient department.

Thus, in addition to a high diagnostic efficiency videothoracoscopy can be used as therapeutically. It allows you to solve one of the very complex problems – to remove floating broken ribs in violation of the integrity of the skeleton of the chest wall. The advantage of the proposed method is the possibility of simultaneous execution of all necessary procedures to remove lesions from minimally invasive thoracic access.

Conclusions
1. Videothoracoscopy at chest trauma allows us accurately set the topical diagnosis. Furthermore, in contrast to existing methods of diagnosis, allowing simultaneously remove these injury with minimally invasive surgery, especially at patients with floating rib fractures.
2. The applied technique of restoring the integrity of the chest in case of floating rib fracture under videoassisted thoracoscopic control allows to securely stabilizing the chest wall without resorting to a wide dissection of injured soft tissue.

References

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