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CLINICAL AND ORGANIZATIONAL ASPECTS OF SURGICAL CARE FOR VICTIMS WITH UNSTABLE PELVIC INJURIES IN POLYTRAUM

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The work is based on improving the results of treating victims with unstable pelvic injuries with polytrauma. An analysis of the treatment of 406 victims with unstable pelvic injuries with polytrauma (ISS≥17 points) is presented. In order to improve care for victims with severe and extremely severe combined pelvic injuries in the hospital, we used an improved protocol scheme of surgical treatment in victims of this group, which includes time intervals and corresponding priority actions taking into account the injury severity and traumatic disease prognosis. Active surgical tactics in the early and late periods of traumatic disease permitted to increase the number of internal metal osteosynthesis in this category of victims from 40.3 % to 72.06 %, to reduce the proportion of conservative treatment, which leads to significant disability of victims from 53.66 % to 30.61 %.

Keywords: combined trauma, fractures of the pelvis, traumatic disease, surgical tactics.

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КЛІНІЧНО-ОРГАНІЗАЦІЙНІ АСПЕКТИ НАДАННЯ ХІРУРГІЧНОЇ ДОПОМОГИ ПОСТРАЖДАЛИМ З НЕСТАБІЛЬНИМИ ПОШКОДЖЕННЯМИ ТАЗА ПРИ ПОЛІТРАВМІ

В основі роботи – покращення результатів лікування постраждалих з нестабільними пошкодженнями таза при політравмі. Проведено аналіз лікування 406 постраждалих з нестабільними пошкодженнями таза при політравмі ((ISS≥17 балів). З метою покращення надання допомоги постраждалим з тяжкою і вкрай тяжкою поєднаною травмою тазової ділянки на госпітальному етапі, нами використана удосконалена протокольна схема хірургічного лікування постраждалих даної групи, яка включає часові інтервали і відповідні їм пріоритетні дії з урахуванням тяжкості травми і прогнозу клінічного перебігу травматичної хвороби. Активна хірургічна тактика в ранньому та пізньому періодах травматичної хвороби дозволила збільшити кількість внутрішнього металоостеосинтезу у цій категорії постраждалих з 40,35 % до 72,06 %, зменшити питому вагу консервативного лікування, яке призводить до значної інвалідизації постраждалих з 53,66 % до 30,61 %.

Ключові слова: поєднана травма, переломи кісток таза, травматична хвороба, хірургічна тактика

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Modern injuries of the pelvic area are mainly (in 60-70 % of cases) severe multiple and combined trauma [1, 3, 4], in the treatment of which an important place is occupied by the quality of the surgical care organization, starting from the admission department. The complexity of diagnosis, severity of injury, rapid development of the terminal condition require the availability of stocks of plasma substitutes and erythrocyte mass, the presence of special tools and devices for the pelvis, trained and well-organized team of surgical doctors, especially anesthesiologists, resuscitators, orthopedists, orthologists urologists, neurosurgeons and angiosurgeons for simultaneous intensive examination and parallel resuscitation and surgical treatment according to the standards adopted in many European countries – ATLS protocols [7, 8], which should change the tactics of passive monitoring or exclusively conservative treatment of unstable pelvic injuries. The use of conservative treatment only for unstable pelvic injuries leads to unsatisfactory results in 35–66.7 % or to unsatisfactory and satisfactory together in 72.8–85 % [9, 10]. However, in severe pelvic injuries, the most important task is to save the patient's life, sometimes even due to poor functional outcome of treatment. The group of authors believes that it is necessary to use external fixation devices (EFD) in the acute period of injury, and then, if possible, within 3 weeks to replace the method of treatment with internal or combined metal osteosynthesis (MOS), due to more accurate repositioning fragments, greater mobility of the victim, better functional results. Thus, these two methods of surgical treatment are not opposed, but complement each other [4, 5, 6].

The purpose of the study was to improve the results of surgical treatment in victims with combined pelvic injury and unstable pelvic ring in polytrauma by developing, justifying and implementing a system of surgical care based on the injury severity, predicting the clinical course, modern diagnostic methods and differential surgical tactics at different periods of the traumatic disease.

Materials and methods. An analysis was performed of the treatment in 406 victims with unstable pelvic injuries in polytrauma (IPIP) (ISS⩾17 points), who were hospitalized in the polytrauma department of the Kyiv City Clinical Emergency Hospital. To study surgical tactics in the acute (1-2 days) period of traumatic disease (TD), all patients were divided into 2 clinical groups: the main – 137 (33.74 %) victims and the comparison group – 269 (66.26 %) victims. The total mortality was 44.53 % and 69.9 %, respectively.

To objectify the data obtained, the main group and the comparison group were formed in such a way that did not differ by gender, age of patients, type and mechanism of injury, number and severity of damaged anatomical areas (DAA), severity of injury, severity of traumatic shock, nature damage to the pelvic ring and pelvic organs. In the study groups, all victims had unstable pelvic injuries, namely types B and C according to the international classification of AO (M. Tile, 2003)

The victims of the main group underwent differential surgical treatment based on the developed scales for assessing the injury severity, prognosis of traumatic disease (TD) depending on its periods, as well as proposed modern methods of diagnosis and treatment of pelvic injuries and other AD. For the treatment of the comparison group patients, surgical tactics were used in accordance with the "Temporary industry unified standards of medical technologies for the diagnostic and treatment process of inpatient care for the adult population in the hospitals of Ukraine."Quantitative assessment of the anatomical lesions severity was performed on the ATS scale, anatomical and functional changes during admission on the FTS scale. All scales were developed by the staff of the Department of Military Surgery UMMA (Zarutsky Y.L., Denisenko V.N., Burluka V.V., Bondarenko V.V., Zhovtonozhko O.I., declaratory patents for inventions, 2003, 2011). Asessment of central hemodynamics was performed using integrated body rheography (IBR) according to M.I. Tyshchenko (1973) with the calculation of anatomical and functional index (AFI). Statistical processing of the results was performed using Student's criterion number and the method of determining the influence of the factor on the trait (Pearson's criterion $\chi 2$).

In order to establish organizational, clinical-diagnostic and treatment-tactical errors in the treatment of victims with unstable pelvic injuries with polytrauma, which could lead to death in the acute period of TD, time monitoring was performed at an early hospital stage in patients who died during this period in both groups of study, the analysis of sequence and duration of surgical interventions on various AA, the analysis of conclusions of forensic medical examination.

In the II (days3–7), III (days8–21) and IV (more than 21 days) periods of TD in the victims of the main group on the choice of optimal surgical tactics was decided for the treatment of unstable pelvic injuries, taking into account the type of fracture, time after injury, risk of local infectious complications.

Results of the study and their discussion. Among those who died in the acute period of TD (185 cases), in the main group (39 patients) the mean time of examination was 29.81±6 minutes, the time from admission to the operating room – 32.93±9 minutes, the duration of surgery – 144, 22±18 min For the victims of the comparison group (146 patients), the mean examination time was 57.82±12 minutes, the time from admission to the operating room – 62.54±11 minutes, the duration of the surgical intervention – 154.43±13 minutes. The analysis showed that the first two indicators of the group differed significantly ($p<0.05$), while the duration of surgery did not reveal such a difference ($p <0.05$). A significant percentage of time was occupied by surgery, and therefore determining the scope of interventions, their sequence, duration in the acute period of TX is important for victims of IPIP, where along with cavitary surgery (skull, chest, abdomen) there are questions about the need and possibility manipulations on the pelvic bones.

After analyzing the conclusions of the forensic examination, it was found that in 72 (28.92 %) cases there was a discrepancy between mild pelvic damage clinically and radiologically and more severe at autopsy. Most often, no damage to the posterior structures of the pelvic ring was detected, due to the fact that X-ray examinations of the pelvis were mostly performed in one projection.

With the increase in the number of damaged AA and their severity, the number of surgical interventions per victim increased. In such cases, there was a need to choose the sequence of their implementation with the definition of the nature and timing of surgical interventions in the pelvic area. In most of the victims, surgical interventions were performed sequentially, with the fixation of unstable pelvic injuries in 2–3 turns. With vertically unstable injuries, in the presence of Gantz forceps, the latter imposed primarily – 10 (13.33 %) cases, in 5 patients for hemostasis against the background of unstable hemodynamics extraperitoneal tamponade was performed of the pelvic cavity for the period of 24 to 48 hours.

In 9 (12.0 %) victims, due to severe traumatic brain injury and intracranial hematoma, simultaneous operations were performed – skull trepanation+ external fixation device EFD on the pelvis. A significant part of the operations was performed on the abdominal organs, including intraperitoneal rupture of the bladder with subsequent sequential fixation of the unstable pelvis in EFD – 32 (42.67 %) surgeries, in 6 of them, due to extremely severe trauma and unstable hemodynamics , performed tamponade of the abdominal cavity on the principles of "damage control". In 13 (17.32 %) cases, Bulau pleural cavity drainage, epicystostomy, fixation of pelvic injuries in EFD fixation of fractures of long EFD bones were performed sequentially.

In order to improve the care of victims with severe and extremely severe multiple and combined pelvic injuries at the hospital stage in the first hours after admission, we used an improved protocol for surgical treatment of victims with IPIP, which includes time intervals and corresponding priority actions taking into account the severity of injury clinical course of TD (table 1).

Table 1

Distribution of surgical interventions and manipulations by volume and performance duration in the acute period of TD

Volume of intervention	Terms of performance	Nature of surgical interventions and manipulations
Minimal – extremely severe injury – ATS (⩾42 points), FTS 7-9, unfavorable prognosis	Up to 20 min	– tamponade of parenchymal organs' ruptures; – tamponade of the abdomen and pelvic cavity; – hemostatic sutures on the parenchymal organ; – thoracotomy for profuse bleeding; – pelvic forceps Gants or EFD – a simplified version, in extreme cases – the pelvic girdle; – decontamination of the hollow organ; – percutaneous subfascial stabilization of the floating segment of the ribs with Ilizarov spokes; – plaster splints on the extremities.
Reduced – severe trauma – ATS (25–41 points), FTS 4–6, prognosis is doubtful	20–40 min	– suturing of the parenchymal organ; – sutures of hollow organs, resection without anastomosis; – splenectomy, nephrectomy; – extrapleural fixation of the floating ribs fracture with spokes; – thoracotomy for prolonged bleeding; – pelvic forceps Gants, EFD on the pelvis – a simplified version; – bandaging, temporary prosthetics, vascular sutures; – EFD on long bones without reposition; – splint on the upper limb; – limb amputation.
Complete – minor injury, ATS⩽24 points, FTS 1–3, prognosis is favorable	Over 40 min	– skull trepanation; – organ-preserving operations on parenchymal organs; – resection and anastomoses of hollow organs; – vascular anastomoses; – the full range of operations on the chest; – pelvic forceps Gants, EFD on a pelvis in various modifications; – MOS of the anterior semicircle of the pelvis with suprapubic or laparotomy access; – EFD in fractures of long bones with elements of reposition of fragments.

Note: MOS - metal osteosynthesis

Active implementation of an improved scheme of surgical treatment in patients with IPIP on admission to determine the injury severity, sequence and priority of surgical interventions, the use of the principles of "damage control" for severe and extremely severe patients (ATS – 25–41, ⩾42 points), reduced mortality among victims of IPIP in the acute period of TD (up to 48 hours) from 77.66 % to 63.93 %, $p<0.05$, overall mortality from 69.89 % to 44.53 % ($p<0.01$).

In the II, III and IV periods of TD 221 victims with IPIP were treated, in the main group – 98 (44.34 %), in the comparison group – 123 (55.66 %). Surgical treatment of unstable pelvic injuries, which included external metal osteosynthesis (MOS) of EFD in different variants, internal MOS (replacement of MOS, primary internal MOS), combined MOS taking into account our proposed differential surgical tactics in patients of the main group of 69.3) cases, in the comparison group this method of treatment was observed in 57 (46.34 %) patients, $p<0.01$, $\chi 2=11.791$. Conservative treatment took place in 30 (30.61 %) cases of

the main group and 66 (53.66 %) – comparison groups. Depending on the type of instability of the pelvic ring, the ratio of surgical treatment to conservative in the study groups was: the main group – type "B" – 2.8: 1, type "C" – 1.5: 1, the comparison group – respectively 1.1: –1, –1: –2.6.

In 16 (32.0 %) victims of the main group with rotational-unstable injuries of the pelvic ring (type "B"), surgical treatment in EFD remained final. In 6 of them for 3–21 days after the injury and in 4 for more than 21 days the EFD was reassembled in order to correct the position of bone fragments during gross deformations. In vertically unstable fractures (type "C") in 3 (16.67 %) cases, EFD remained the final method of treatment with reassembly for 3–21 days after injury in all victims. Thus, in the main group of the study, the hardware treatment of the unstable pelvic ring was final in 19 (19.39 %) patients with modification of the apparatus in 13 (68.42 %) victims, and in 9 (47.37 %) of them, the correction was performed on 3–21 days after injury.

Among the victims of the comparison group, hardware treatment was final in 34 (27.64 %) patients, most of whom had rotational-unstable fractures – 29 (59.18 %), vertically unstable amounted to 5 (62.5 %) cases. Reassembly of EFD was performed in 11 (32.35 %) victims, of which 7 – more than 21 days after injury.

Taking into account the severity of the injury and the prognosis of the clinical course of TD, respiratory and circulatory changes, which were determined by integral rheography of the body IRGB and red blood cells, we developed a scheme of surgical treatment of unstable pelvic injuries in patients with IPIP in II, III and IV periods of TD (fig. 1).

1. In mild and severe trauma (ATS≤24, 25–41 points, AFP up to 620 points) and a favorable prognosis of the clinical course is possible, if indicated, implementation of internal MOS, starting from 5–7 days after injury;

2. With extremely severe injury (ATS≥42 points, AFP more than 620 points) and a favorable prognosis, invasive operations on the pelvic bones can be performed from 10–14 days after injury;

3. In case of doubtful prognosis, which is most characteristic of severe and extremely severe injury, combined MOS, or external fixation device EFD, as the final treatment option, is the method of choice;

4. In case of unfavorable prognosis, we use minimally invasive methods of treatment of unstable pelvic injuries with indications – EFD in different variants with mandatory (68.42 %) reassembly during treatment, preferably 3–21 days after injury.

Fig. 1 Scheme of surgical treatment method choice of unstable pelvic injuries in patients with IPIP in II, III, IV periods of TD

In the main group, where we developed the differential tactics of treatment of patients with IPIP, internal MOS in the early and late periods of TD was performed in 49 (72.06 %) patients who underwent surgical treatment of unstable pelvic ring: replacement method – in 26 (53, 06 %), primary internal MOS - in 18 (36.73 %), combined MOS – in 5 (10.20 %). 35 (71.43 %) surgical interventions were performed on days 3–21. In 30 (30.61 %) cases, treatment was conservative, mostly due to the severity and timing after injury or lack of indications for surgery. In the comparison group, 23 (40.35 %) internal MOS were performed, among those who performed operations on the pelvic ring: replacement of the method – in 11 (47.83 %) patients, primary internal MOS – in 6 (26.09 %), combined – in 6 (26.09 %), two thirds of operations were performed more than 21 days after admission. Conservative treatment was noted in 66 (53.66%), which is largely due to both the injury severity and passive surgical tactics of treatment.

The obtained data of the research indicate that in patients with IPIP for surgical treatment of unstable pelvic ring can be used various methods taking into account the injury severity of, the prognosis of the clinical course of TD. Active surgical tactics in the early and late periods of traumatic disease using a differential approach permitted to increase the number of internal MOS in this category of victims from 40.35 % to 72.06 %, reduce the proportion of conservative treatment, which leads to significant disability of the victim from 53, 66 % to 30.61 %.

Some authors adhere to a fairly active surgical tactics in the acute period of injury, especially when the victim is admitted, and use the rule "if possible all at once", in particular for pelvic fractures. In this way, they make a maximum of interventions against the background of the compensatory effect of urgent adaptation mechanisms [2, 7]. Instead, it is very difficult to establish the physiological limits of such possibilities, and therefore most recently support the tactics of "demage control" in injury surgery and in particular in the surgery of pelvic injuries in polytrauma [5, 10].

The problem of choosing a method of surgical treatment of unstable pelvic injuries with polytrauma is quite debatable. Some authors [1] consider external MOS devices of different design as a method of choice for this category of victims, in most cases – it is the final treatment with elements of external correction at different stages, explaining this primarily by low trauma, which is very important in polytrauma and reducing the risk of local infectious complications.

Another group of authors [3, 4, 5] believe that it is necessary to use external fixation device (EFD) in the acute period of injury, and then, if possible, within 3 weeks to replace the method of treatment with internal or combined MOS, due to more accurate repositioning fragments, greater mobility of the patient, better functional results. Thus, these two methods of surgical treatment are not opposed, but complement each other.

Conclusions

1. Tactics of surgical interventions for injuries of the pelvic localization, unstable pelvic fractures, pelvic injuries in the acute period of traumatic disease should be based on urgent indications, in compliance with the principles of "damage control", the possibility of immediate or sequential emergency external fixation of the pelvic ring to save the patient's life.

2. Active surgical tactics in the early and late periods of traumatic disease using a differential approach permitted to increase the number of internal MOS in this category of victims from 40.35 % to 72.06 %, reduce the proportion of conservative treatment, which leads to significant disability of the victim from 53,66 % to 30.61 %.

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