УДК 615.849

RHEABILITATION RESULTS OF PATIENTS WITH ACCIDENT RADIATION INJURIES

Moroz V.A., Starenkiy V.P.
Grigoriev's institute of a medical radiology, Kharkov

SUMMARY

The purpose of the work based upon the treatment results of 29 patients with radiation injuries received in accidents are to determine optimum his treatment tactics. Special attention was focused on surgical rehabilitation and mistakes and inaccuracies, made during its carrying out. The calculation of the received dozes was carried out of the basis of the calculated simulation method of an accident in consideration of the source's activity, geometry of the exposure and time of contact with it. The observation of the patient under considerations enables us to assert that in the acute period of the radiation injury (prior to 3 months after the accident) the reconstructive surgical treatment is expedient only in conditions of x-ray overexposure, with only surface injure of tissues, especially when there is their inflammatory response. For better remote results of treatment surgical rehabilitation of the consequences of a radiation trauma, including determination of the coretraction scope and the type of an operation, should be postponed for 6 months, which will enable to do it more precisely.

KEY WORDS: radition accidents, radition injuries, surgical treatment

INTRODUCTION

Wide use of sources of ionizing radiation in various spheres of modern human activity being determines immanent level of accidental traumatism including radiation exposure. In the recent years there appeared a tendency to allocate profession groups especially hazardous in terms on accident exposure of hands, eyes, other part of body under industrial conditions (dosimetricians, defectoscopians, orthopedists, X-ray technicians etc.) [1, 2]. And the quality of medical rehabilitation of such traumas, often reducing in disabilities, has according to the data available in the literature, invaluable significance for diagnosing of working capacity [3 -5].

The purpose of the given work was to determine optimum treatment tactics of accidental radiation injuries basing on the experience of the specialized clinic attached to Grigoriev's Institute of Medical Radiology. Special attention was paid to surgical rehabilitation and analysis of mistakes and inaccuracies made during its carrying out. Besides, we intentionally avoided discussing important but outsizing the limits of the given research points concerning treatment of the early phase of a radiation trauma.

MATERIALS AND METHODS

For the period between 1975-1999 29 patients with radiation injuries of the second and more severity according to SOMA/EORTC classification, received under conditions of accident exposure, were treated in the clinic [6]. This contingent of patient underwent various operative interventions in the period from several days till 10 years after the radiation trauma. The majority of the patients (23 or 79,3% respectively) were professional workers and the rest 20,7% were so-called "unskilled" contingent, who had received their injuries under conditions of accidental access to sources of ionizing radiation. Besides children made two thirds of the latter group (4 out of 6). And only three patients from the total number received radiation traumas as the result of X-ray radiation (2 X-ray technician and 1 patient during the brachytherapy of skin papillomas when the roentgen apparatus got broken).

The dozes of radiation, received by the patients on the skin and time of exposition varied within rather wide scope - from 0,5 till 71 Gy, received in the periods from tens of seconds till 18-hour-contact with a radiation source. Calculation of the levels of the received dozes was carried out on the basis of the method of calculated simulation of an accident in consideration of the source's activity, geometry of exposure and the time of contact with it. They were further specified in compliance with the established limits according to the course of real clinical picture of the radiation injury. Additional dozes of skin exposure, caused by its nuclide contamination and their incorporation, were calculated according to V. Shamov's recommendation [7].

The effectiveness of the rehabilitation measures was evaluated in the remote and immediate periods of time after its carrying out according to Karnofsky's index [8].

Statistical handling of the results was done on AT/PC using the package of application programs Mathcad 7.0.

RESULTS AND DISCUSSION

Most frequently in surveyed group of patients there was damage of hands (25 patients), then thigh (5) and thoracic or abdominal wall (by 3 each). In the first case it was explained by high functional loading of a hand, as instruments of work, and in other cases - arrangement of pockets, in which injureds put radiation source. In third of cases (9 patients) damage were combined. Thus the defeat of hands was combined with a trauma of thigh. At one patient the injury were developed in three mentioned localizations.

The generally accepted method of treatment of radiation injuries is the complete excision of non-viable tissues with their substitution for functionally suitable flaps [9, 10]. At the same time this task has (as the literature and our own experience prove) many characteristics peculiarities (impossibility in many cases to use local flaps, forced long-term immobilization of limbs along with skin grafting, psychological stress, etc.). Besides, high functional value of hand performs special requirements to as precise localization of an injury as possible [9, 11].

Knowledge of peculiarities of injuries of different segments of a hand and the data of calculated simulation of an accident are of great helping here. Thus, analyzing the frequency and character of traumas in our observations we discovered high frequency of injury of the most active segments of hand. Besides, these segments were injured the most heavily. For example, the distal phalange of the first finger was on the first place, then followed the distal phalange of the second finger of "leading" hand (left for left-handers). On case of injury from an isotope source (for example, ^{137}Cs) the zone of injury received rather high local dozes of radiation in this area, explained by features of dozes distribution from such source (fig. 1). In case of the injury from a source of x-ray radiation, the tendency of injures distribution was similar, though the level of received dozes was significantly less.

It is necessary to note that in overwhelming majority of cases, when the source of radiation trauma was technical, no significant radiation impact on the whole organism was rendered. At the same time, under conditions of dehermetization of radioactive sources the doze of radiation an exterior β-contamination of skin and incorporation of the corresponding radionuclides inside. We observed three cases of such type (50% of "unskilled" contingent of the injured).

The modeling of radiating failure all the same demonstrated some impossibility of precise calculation of dozes received by tissue. For purpose of further planning of operative intervention,

wh ı the
fig. ıme
has vere
ove left
har that
tim of
pat the
acu ıkes
nec

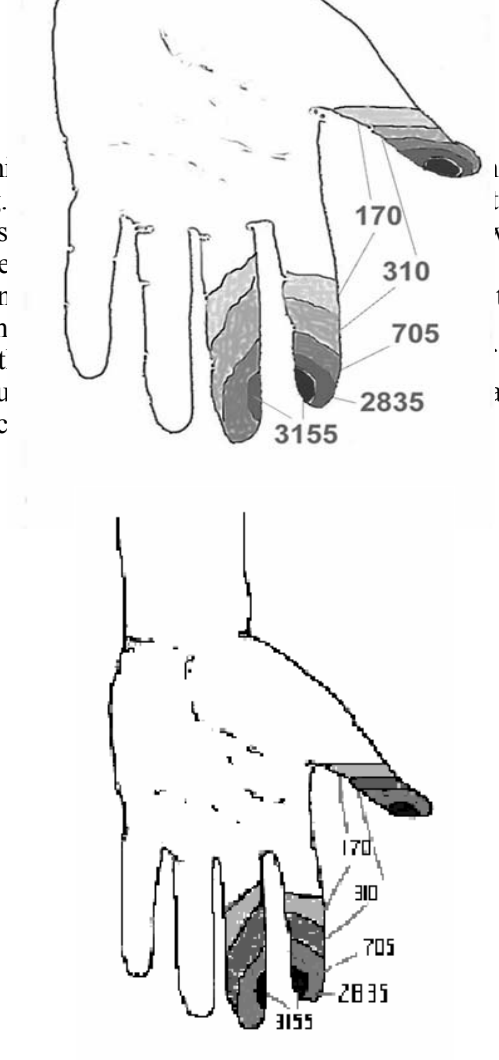

Fig. 1. The circuit of account an accidental dozes under simulation method (Gy * 100).

No doubt that for right understanding of the radiation trauma prognosis it is necessary to differentiate between the early (prior to 6 months after the accident) and the late phases of its course, which are quite different in their characteristics of processes of destruction and regeneration of tissues. This has numerous evidences in the literature [6, 12]. The observed tendency of reduction of the value of the Karnofsky's index, which took place in the remote period of time after the trauma in the same conditions, has, as it appears, character of a natural process, not depending directly on the peculiarities of radiation injury [4, 9].

Going back to above-stated observation (fig. 1) it is necessary to note that absolutely justified active wait-and-see tactics of treatment in the early phase of the radiation trauma, especially in conditions of the accompanying ^{137}Cs. Incorporation these radionuclide and skin contamination with it, was later supplemented with the inaccuracy in applying the conservative therapy (which first seemed to justify itself) for treating the late radiation injury which appeared after 28 months. At this time there obviously were, to our mind, absolute indications to surgical treatment, which no doubt would help to avoid the consequent complications

(osteomyelitis, ankylosis) and to save the hand's function.

The expediency of the early surgical treatment (prior to 3 months after the trauma) is justified, on our mind, only in two cases:

a) in case of x-ray overexposure with relatively superficial trauma of tissues, especially when their inflammation reaction is conspicuous and
b) in case of obviously unfavorable prognosis for wound general subsistence (open combined traumas, threat perforation radiation ulcer in a cavity etc.).

Complications of the operative treatment certainly influence full value results of rehabilitation of a radiation trauma. Planning of the rehabilitation measures, including determination of the best deadlines, extent and character of operative intervention should be carried out with account of the accompanying pathology. In some cases they have special importance.

Addressing to statistic of usual (not radiation) industrial disabilitation, it is necessary to note, that in 38,8% of cases steady disability after an injury of hands is caused by tardy and incorrect treatment [5]. In our study at 8 cases, thriugh with developed complication (wound suppuration, graft rejection etc.) repeated operation was necessary.

Analyzing the characteristics of the hands' function in the observed contingent of the patients, we find it the most expedient not to postpose the decision as to operative treatment for more than 6 months. Patients treated in such a way had the best remote results. Concerning injury of other localizations such importance of exact observance these terms morally it is not required.

In cases of combined radiation trauma mostly the early surgical treatment of the injury manageable according to the principle of the "leading syndrome", but also obviously inexpedient. Its results had in the remote period of time lowest parameters of Karnofsky's index.

So, basing on our own experience and data of the literature we can come to the conclusion, that reconstructive surgical treatment in the acute phase of the radiation trauma (prior to 3 months after the accident) is absolutely justified only in conditions of x-ray overexposure, with relatively superficial trauma of tissues and especially when their prognosis are conspicuous. In this time it is the most expedient to concentrate on the adequate conservative treatment aimed at restoring of trophic of tissues, eliminating of syndromes of local and general intoxication and counteraction to allergic reaction.

In conditions of the accompanying pathology in order to achieve better remote results of treatment it is expedient to postpone planing of rehabilitation measures, including determination of the extent of coretraction and the type of operative intervention, for 6 months, which will enable to do it more precisely. Emerging of a retarded radiation injury (ulcer, fibrosis) on the injured zone must be an absolute indication to an operation. Only surgical method of treatment makes it possible to provide full value rehabilitation of the patient and to secure him from further complications and malignization in the remote period of observation. In all cases the type of operative intervention should be carefully planned with consideration of the geometry and received dozes of radiation, individual peculiarities and accompanying postradiation syndromes.

REFERENCES

1. Goldstone K.E., Wright I.H., Cohen B. // Br. J. Radiol. - 1993. - Vol. 66. - P. 899 – 902.
2. Berger M.E., Hurtado R., Dunlap J., et. al. // Health Phys. - 1997. - Vol. 72, №3. - P. 343-348.
3. Pary J.-J., Denekamp J., Letschert J., et. al. // Radioth.and Oncol. - 1995. - Vol. 35. - P. 11-15.
4. Peters L.J., Withers H.R., Brown B.W.//Int. J. Radiat. Oncol. Biol. Phys. – 1995 - Vol. 31, №.3. - P. 1349-13551.
5. Torii S., Namiki Y., Mori R. // Plastic and Reconstr. Surg. - 1987. - Vol. 79, № 4. - P. 600-608.
6. Pary J.-J., Denekamp J., Letschert J., et.al. // Radioth.and Oncol. - 1995. - Vol. 35, №1. - P. 11-15.
7. Шамов В.П. Тканеводозиметрические харатеристики основных радиоактивных изотопов.- М: Атомиздат. - 1972. - 112 с.
8. Bloom J.R. // Cancer. - 1991. – Vol. 67, №3. - P. 855-859.
9. Parry S.W. // Clin. plast. surg. - 1989. - Vol. 16, №3. – P. 577-586.
10. Бардычев М.С., Цыб А.Ф. Местные лучевые повреждения.- М.: Медицина. - 1985. - 240 с.
11. Arnstein PM. Richards AM. Putney R. // Journal of Hand Surgery - British Volume. - 1994. - Vol. 19, №3. - P. 393-396.
12. Fajardo L.F. // Semin. Roentgenol. - 1993. - Vol. 28, №2. - P. 297.

РЕЗУЛЬТАТИ РЕАБІЛІТАЦІЇ ХВОРИХ З АВАРІЙНИМИ РАДІАЦІЙНИМИ УШКОДЖЕННЯМИ

Мороз В.А., Старенький В.П.
Харківський НДІ медичної радіології ім. С.П. Григор´єва

РЕЗЮМЕ

У роботі оцінений досвід лікування 29 пацієнтів із радіаційними ушкодженнями, отриманими в аварійних умовах. Метою було визначення оптимальної тактики лікування таких хворих на досвіді спеціалізованої клініки ХНДІМР. При цьому особлива увага приділена досвіду хірургічної реабілітації, а також аналізу допущених помилок і неточностей у процесі її проведення. Підрахунок рівнів поглинених доз проводився методами розрахункового моделювання аварійного випадку з урахуванням активності джерела іонізуючої радіації, геометрії опромінення і часу контакту з ним. Аналіз даних дозволив встановити, що в гострому періоді радіаційної травми (до 3 місяців після аварії) проведення реконструктивного хірургічного лікування повністю виправдане тільки за умов рентгенівського опромінення, при відносно поверхневій травмі тканин і, особливо, при значній у цей час запальній їх реакції. У той же час з метою поліпшення віддалених результатів лікування, планування реабілітаційних заходів, включаючи визначення обсягу висічення уражених тканин і типу хірургічного втручання доцільно відкласти на 6 місяців, що дозволить виконати його з більшою точністю.

КЛЮЧОВІ СЛОВА: радіаційні аварії, променеві ушкодження, хірургічне лікування

РЕЗУЛЬТАТЫ РЕАБИЛИТАЦИИ БОЛЬНЫХ С АВАРИЙНЫМИ РАДИАЦИОННЫМИ ПОВРЕЖДЕНИЯМИ

Мороз В.А., Старенький В.П.
Харьковский НИИ медицинской радиологии им. С.П. Григорьева

РЕЗЮМЕ

В работе оценен опыт лечения 29 пациентов с радиационными повреждениями, полученными в аварийных условиях. Целью являлось определение оптимальной тактики лечения таких больных на опыте специализированной клиники ХНИИМР. При этом особое внимание уделено опыту хирургической реабилитации, а также анализу допущенных ошибок и неточностей в процессе ее проведения. Подсчет уровней поглощенных доз проводился методами расчетного моделирования аварийного случая с учетом активности источника ионизирующей радиации, геометрии облучения и времени контакта с ним. Анализ данных позволил установить, что в остром периоде радиационной травмы (до 3 месяцев после аварии) проведение реконструктивного хирургического лечения полностью оправдано только в условиях рентгеновского переобучения, при относительно поверхностной травме тканей и, особенно, при выраженной в это время воспалительной их реакции. В то же время с целью улучшения отдаленных результатов лечения, планирование реабилитационных мероприятий, включая определение объема иссечения и типа хирургического вмешательства целесообразно отложить на 6 месяцев, что позволит выполнить его с большей точностью.

КЛЮЧЕВЫЕ СЛОВА: радиационные аварии, лучевые повреждения, хирургическое лечение