Biological activity of the mummy. Publication 4: Regenerative Action in Fractures bones

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I. Historical background

Among the few remedies that have been successfully used for many centuries in folk medicine for bone fractures, ancient legends, manuscripts and books highlight the mummy.

Back in the 1st millennium AD, the brilliant scientist-encyclopedist from Khorezm Abu Raikhan-Muhammad ibn-Ahmed al-Biruni (973-1048) described the medicinal properties of the mummy in this way:resin (mummy) in some respects corresponds to amber and aromatic resins and deserves that we keep it for its value and to help someone who breaks some bone in his body ”[7]. At about the same time Avicenna (980-1037) in the "Canon of Medicine" in the section "Tools with joints" recommended: "[Shilajit] in the form of drinking and rubbing [as] an excellent [remedy] for pain in dislocation and fracture... "[1].

Abubakr Rabi al-Bukharon (960 AD), Muhammad Arzani (1735), Muhammad Hussein Shirazi (1762), Al Komuz Muhit (1795) were also used for bone fractures and dislocations. , Alkhakhim Muhammad Khusain Alaviy (1888) [2; 17; 19].

II. Experimental research results

2.1. Reparative regeneration

The first scientific publications on the stimulation of bone regeneration by mummy preparations in experimental fractures date back to 1964. Research by V.N. Ismailova (1964) testify that mummy-asil causes the formation of massive calluses in rabbits on average after 10.5 days [9]. In the later works of V.N. Ismailova [10–12] was the first to study the effect of mummy on the fusion of closed bone fractures, depending on the age of laboratory animals.

In 3 series of experiments on rabbits, doses of 0.01-0.05-0.1-0.2 g / kg were used. In all series, animals aged 3 to 8 months in the operating room under local novocaine anesthesia underwent a closed fracture of both bones of the right forearm in the diaphyseal region with fixation of the injured limb [10].

In series I - control (3 groups - 25 rabbits) - fracture treatment was carried out without the use of stimulants. In series II (10 rabbits), the experimental animals received aloe extract for 30 days as an injection under the skin at 0.2 ml / kg. In series III (8 groups - 85 rabbits), after the fracture, the drug Mumiyo Asil was administered at various dosages. The same series included 3 groups of rabbits, on which a sample of the drug "M.P." (is an artificially obtained substance similar in physical, chemical and medicinal properties to mummy) [10]. During the experiment, it was found that the most harmless and effective doses of mumiyo-asil and the drug "M.P." in the treatment of closed diaphyseal fractures of long bones in young rabbits are: 0.1–0.2 g / kg (orally) [10].

As a result of clinical and X-ray studies, the following pattern was revealed: the younger the animal is, the more active bone tissue regeneration occurs in comparison with control animals [10]. For example, in three-month-old rabbits, the union of bone fractures decreased by 6 days in comparison with control animals; for five-month-olds - for 8 days; for seven-month-olds - for 10 days [13]. In addition, the drug mumie-asil had a beneficial effect on the entire body, accelerating the morphological normalization of internal organs [10].

It is important to note that not all mummy-asil specimens have the same regenerative

activity. Thus, the sample obtained from the raw materials of the Gissarai ridge did not have a noticeable stimulating effect on the regeneration of bone tissue, which, according to the author, is due to the presence of a large amount of impurities in the raw material [10], the composition of which is not indicated in the work.

X-ray and morphological changes in the area of bone fracture under the influence of mummy in dynamics were investigated by R. Bekiev (1965). The experiments were carried out on healthy rabbits aged 3–6 months, weighing 1.5–2.5 kg [4; 6].

In series I, rabbits (11 - experimental and 11 - control group) received a closed fracture of the left forearm. After 30 minutes, the bone fragments were repositioned with a circular plaster cast for 5 days. The state of the fragments after reduction and the degree of their consolidation were monitored by X-ray [6]. The rabbits of the experimental group in the morning before feeding daily for 12 days received a 7% solution of mummy inside through a tube at the rate of 1 cm3 per 1 kg of body weight [6]. In series II, rabbits (10 - experimental and 5 - control group) received an open transverse fracture of the 10th rib, and the wound was tightly sutured [6].

During the experiment, it was shown by X-ray that the process of callus formation in closed forearm fractures in rabbits of the experimental group occurred 8-10 days earlier than in animals of the control group. With open fractures of the ribs, there was also a slight acceleration of the process of callus formation in the experimental animals as compared with the control group. In particular, in the animals of the experimental group, the filling of the defect with osteoid tissue was faster. The results of histological studies also confirmed the difference in the rate of callus formation in the experimental and control groups [6].

The effect of mummy on regenerative processes in an experiment on 102 dogs and 35 rabbits was studied by A.Sh. Shakirov (1965-1968, 1978) [21-24].

The dogs were divided into 5 series depending on the dosage and duration of the use of mumiyo (table 1) [21; 22]. Dogs received the drug with food, and rabbits were injected with tweezers at the base of the tongue. Fractures of the tibia or radius of the animals were performed surgically under anesthesia [21; 22]. Clinical and radiological data of operative fractures of long tubular bones (tibia and radius) of dogs showed that under the influence of mummy, the processes of callus formation and the timing of fracture consolidation accelerated by 8–17 dnay [21; 22]. The author explains the mechanism of stimulation of reparative osteogenesis in fractures under the influence of mummy, on the one hand, by the activation of enzymatic and mineral metabolism, and on the other, by the sensitization of the organism [22].

Table 1

Treatment regimen for fractures in dogs using mummy

Номер серии	Разовая (ежедневная) доза, г.	Продолжительность эксперимента, сут.	Курсовая доза, г.
I	0,20	10	2,0
II	0,10	25	2,5
III	0,10	30	3,0
IV	0,10	40	4,0
V	0,15	20	3,0
	0,10	30	3,0
	Итого:	50	6,0

The results of clinical and radiological studies of operative fractures of the radius in rabbits also confirm the acceleration of the processes of fracture consolidation under the influence of mummy-asil (by 7–15 days) [22]. The data of histomorphological studies (50 dogs and 35 rabbits) indicate a significant difference in the dynamics of the regenerative process that occurs during fractures of the fibula and radius in dogs of the experimental and control groups. The shorter the time elapsed after the fracture and the reception of the mummy, the sharper the difference in the dynamics of healing: the experimental animals showed a more intensive development of the regenerate and its earlier maturation. In more distant terms, after the fracture and the formation of the final callus, the overgrown tissue develops backward. Recovery

normal bone structures are almost the same in both experimental and control dogs [21].

The results of the conducted studies allowed the author to reveal the relationship between the healing time of fractures of long bones and the dosage of the drug [22]. However, unfortunately, no specific data are provided in the work.

A series of studies devoted to the study of the stimulating regenerative activity of mummy of Central Asian origin was carried out by N.M. Madzhidov et al. (1980) [14]. Dogs and rabbits were injected subcutaneously with a 1% solution of hydrochloric morphine a few minutes before the operation. The operative field was treated with a 10% solution of iodine tincture. Under local anesthesia (10 ml of 0.5% novocaine solution), the animals made a longitudinal skin incision (up to 5 cm long) along the radius or fibula and dissected the fascia, moved the muscles apart, exposed the small or radius bone, bite it transversely with nippers, produced hemostasis. Postoperative wounds were sutured tightly with catgut layer by layer, and silk sutures and an aseptic bandage in the form of a roller were applied to the skin [14].

Experimental animals, divided into 5 experimental series, received the mummy orally once a day on an empty stomach together with 50 g of meat: in series I - 0.1 g each for 25 days, in series II - 0.1 g - 10 days , in series III, 0.2 g - 10 days, in series IV - they received a biostimulator (aloe preparation) at a dose of 0.2 ml for 10 days, in series V they received mummy for 50 days: 0.15 g each within 20 days and 0.2 g for 30 days [14].

Dynamic observations have shown that surgical intervention and reception of mummy do not affect the general state of the animal's body. For 3–4 hours after the operation, the dogs remained motionless, drowsy and apathetic under the continued action of morphine. In all animals, on the 1st day after the operation, there was a slight increase in pulse and respiration, which disappeared the next day. The weight of the animals in the first days after the operation decreased by 200–350 g. After 30 days, the weight of the experimental animals was restored, but the control did not.

In the first days after the operation, some animals showed a slight swelling of the paw, which disappears after 3-4 days. By this time, they began to step on the operated limb, and on the 7–12th day they fully loaded the limb. Postoperative wounds in all cases healed by primary intention [14].

Clinical and radiological studies of the fusion of bone fractures in dogs revealed the initial signs of callus formation in the form of a shadow in animals of the experimental group on the 8-13th day, and in the control ones only by the 13-16th day after the fracture. A weak and clear callus was found in experimental animals on the 26th and 29th day, in the control - only on the 26th and 40th day. In animals that took mummy in doses of 0.1–0.2 g for 10–50 days, the process of bone tissue regeneration was accelerated by an average of 10–20 days [14].

The results of X-ray studies of reparative regeneration of bone fractures in dogs showed that mummy accelerates the appearance of the initial signs of callus by an average of 9 days, weak by 15 days, clear by 16 days and massive by 20 days [14].

Based on the research carried out, N.M. Madzhidov et al. a correlation was established between the amount of mummy taken and the time of callus formation. Taking mummy in small doses over a long period is more effective for bone tissue regeneration than using large doses with a short course of treatment [14].

In addition, it was shown that the use of mummy at a dose of 0.15-0.25 g for 10 days has a better stimulating effect (correlation coefficient $r = 0.6 \pm 0.2$; $P < 0.05$), compared with the extract aloe; massive calluses were formed on the 24-30th and 37th days, respectively [14].

In the course of the study, a difference was found between the X-ray and macroscopic patterns of the dynamics of callus formation. So, on the macro-preparation by the 18th day, a new bone formation was noticeable, filling the fracture site completely. The X-ray diffraction pattern at this time revealed only a gap between the fragments [14].

A similar picture of bone tissue regeneration was observed in experiments on adult rabbits with closed fractures of the same type. In the first series of experiments, mummy was injected at a dose of 0.1 g once a day for

for 5 days; in series II - 0.2 g each - 10 days; in series III - 0.1 g each - 10 days; in series IV, rabbits were injected with aloe extract; in series V - mummy 0.2 g for 20 days [14].

An analysis of X-ray images of the injured limb of rabbits showed that the first signs of bone regeneration in the form of a barely noticeable shadow of endosteal callus appeared in control animals on the 11–20th day after the fracture, in experimental animals - by the 7–18th day. Endosteal calluses were formed from the ends of the proximal and distal fragments [14].

Thus, it was found that under the influence of mummy there is a significant reduction in the timing of the appearance of callus, restoration of the trabecular structure of the cancellous bone and the formation of callus [14]. The literature describes studies on the study of the effect of mummy on the formation of callus using radioactive isotopes [14; 21; 22]. For the first time, isotope diagnostics of the effect of mummy on the process of fracture healing at various stages and dosage of the drug was performed by A.Sh. Shakirov [21; 22].

The use of radioactive phosphorus as an indicator makes it possible to trace the process of the introduction of mummy into the tissue of the regenerate and to study the degree of influence of the drug on the process of corns formation in fractures. In the experiment, radioactive phosphorus 32P was injected in the form of an aqueous solution of dibasic sodium phosphate at the rate of 10 micro Curie per 1 kg of animal weight. 24 h after the injection, the animals were sacrificed by injecting 5–10 ml of air into the auricle vein. The radius and ulna of both forepaws were freed from soft tissues. Bone tissue was taken from the areas of the middle third of the radius, that is, from the callus of the operated paw, and from the symmetric intact radius, and weighed portions of 1 g were prepared, which were placed separately in porcelain crucibles and kept in a thermostat at 36 ° C for 24–48 h. Then the crucibles were transferred to a muffle furnace and the bone was burned at a temperature of 900–1000 ° C. The burned bone was ground in a mortar into powder, poured into a test tube, and 2 ml of 50% hydrochloric acid solution was added. After dissolving the bone, 8 ml of distilled water was added to the test tube, mixed, and 0.2 ml was pipetted from the resulting solution into the target.

Preliminarily, 2 drops of a 25% ammonia solution were added to the target. The target was placed in an oven, and after the contents were dried, the pulses from the target were counted in a lead house on a B-2 setup using an end counter. Radioactive phosphorus was injected into the animal's body at various times after the operation: series I animals - on day 5, series II - on day 10, series III - on day 15, series IV - on day 20, V series - on the 25th day, VI series - on the 30th day [14].

Using the method of radioisotope diagnostics, it was found that the process of callus formation intensifies at the site of the operative fracture and begins to develop from the 2nd day after the operation. Shilajit as a biostimulant has not only a direct effect on fracture healing, but also indirectly - as a result of the attachment of the “absorption” reaction of the reticuloendothelial system and the effect on the phagocytic activity of leukocytes [14].

Under the influence of mummy, the absorption of 32P at the site of the fracture increases 2.5–3 [21–24] or 2–3.5 times [14]. This is due to the early processes of callus formation in experimental animals and the intensification of metabolic processes at the site of the fracture, which accelerate the formation of bone regenerate.

Consumption of radioactive phosphorus during consolidation depends on the degree of fracture healing. The largest number of impulses was recorded on the operated paw of animals that received mummy for a long time and, therefore, in greater numbers. At a later date, the regeneration process was more pronounced, and the intensity of isotope accumulation in the fracture area decreased. The first wave of increased impulses occurred on the 15th day after the operation, the second - on the 20th day. After 26 days, 32P uptake decreased and on the following days its decrease in the operated and healthy paws became the same [14].

Thus, using isotope diagnostics, it was found that mummy, containing trace elements similar to trace elements of the bone itself, selectively accumulates in the fracture area to a greater extent during the healing period than at the end of consolidation [14].

2.2. Reparative regeneration in case of adverse effects on the body

R.M. Khaitov (1965–1968), the effect of mummy on the healing of bone fractures was studied under conditions of prolonged exposure to ionizing radiation [18]. The experiments were carried out on rabbits of 9 experimental series. In the last series (25 rabbits), the effect of mummy on the healing of fractures after prolonged gamma irradiation of animals was studied. The rabbits were injected with coamide and mummy starting from the day the fracture was inflicted. Coamid was injected daily intramuscularly for 28 days in the form of a 15% solution of 0.1 ml per kg of body weight. Shilajit was administered orally in 0.15 g pills daily for 12 days. The pills were prepared at the Department of Biological Chemistry of the Samarkand Medical Institute from the extract of the Zeravshan mummy. Dynamic observation of fracture healing was carried out using X-ray images of the injured foot and data from morphological studies [18].

Before treatment, the peripheral blood picture showed white blood lability with a tendency to leukopenia. Analysis of blood smears showed an increased incidence of pycnosis of hypochromates of neutrophil nuclei, the appearance of leukolysis cells and toxic granularity in neutrophils. After treatment with mummy (within 1–2 weeks), these changes disappeared [18].

The foregoing allowed the authors to draw a conclusion about the ability of mummy to improve blood composition and normalize regenerative-reparative processes in bone tissue in irradiated animals [18]. R.Yu. Omirov (1969–1970) investigated the effect of mummy and coamide on the nature and rate of post-traumatic bone tissue regeneration in animals under conditions of chronic exposure to low doses of insecticides (sevin, hexochlorane, methyl mercaptophos), which are known to delay the formation of callus and processes its restructuring [16].

During the experiment, it was shown that mummy has a pronounced stimulating effect on all periods of callus formation, in contrast to coamide, which stimulates only its initial period [16]. Studies of biochemical parameters (cholinesterase, sugar, calcium, phosphorus of total protein and protein fractions) indicated a faster normalization of biochemical and morphological parameters of blood under the influence of mummy [16].

R.M. Maksudov (1972) on the basis of the Uzbek Research Institute of Oncology and Radiology of the Ministry of Health of the Uzbek SSR, the effect of mumiyo-asil on the healing process of closed fractures of long bones of animals under the influence of X-ray radiation was studied [15]. Studies carried out on three series of rabbits indicate that the mummy drug stimulates the fracture healing process in both irradiated and non-irradiated animals [15].

2.3. The effect of mummy on some biochemical parameters in experimental broken bones

In the process of bone formation, the activity of alkaline phosphatase is of great clinical importance. Trauma is accompanied by a significant decrease in the level of blood phosphatase and, thereby, the inhibition of the process of bone tissue regeneration occurs. In this regard, the studies of a number of authors are devoted to the study of the effect of mummy on the activity of alkaline phosphatase.

R. Bekiev studied the activity and level of activity of alkaline phosphatase in the blood of rabbits withtreatment of mummy rib fractures [5]. The study involved 25 rabbits with experimental open fractures of 10 right ribs. The animals of the experimental group (15 rabbits) received a mummy orally through a tube for 12 days in an amount of 0.07 g / kg. The activity of alkaline phosphatase was studied at 1, 3, 10, 13, 16, 21 and 28 days after the fracture [5].

As a result of the research, it was found that the most distinct increase (by 2.2-3 units relative to the initial values) in the activity of blood alkaline phosphatase in rabbits of the experimental group is observed from 13 to 16 days after injury [5], that is, during the formation of callus , which indicates the stimulation of bone tissue regeneration by mummy preparations.

A.Sh. Shakirov (1965-1968, 1978) [21-22] and N.M. Madzhidov et al. (1980) [14] found that under the influence of the mummy, already on the 10-15th day after the operation, positive changes occur in the blood picture of dogs. Starting from the 5th day of the fracture and until the end of the experiment, an increase in alkaline phosphatase is observed, which indicates a positive effect of mummy during the period of depletion of blood plasma elements, due to which

construction of bones occurs [14; 21; 22].

The authors also investigated the effect of mummy on the protein composition of blood in experimental fractures of tubular bones. In experiments on rabbits, it was shown that oral administration of mummy on the 5th and 15th days after the fracture is accompanied by a decrease in the total protein content by 0.1% compared to the preoperative level. Subsequently, this indicator gradually increased and by the end of the experiment exceeded the initial value by 0.2%. On the 5th day after the operation, an increase in the level of albumin was noted, which remained until the end of the experiment [14].

The fraction of α1-globulins in experimental animals decreased by 0.1% compared to the preoperative level, the fraction of α2-globulins - by 1.4%. On the following days, the content of globulin fractions α1 and α2 increased and by the end of the experiment increased by 0.2 and 1.2%, respectively. The content of β1 and β2-globulins decreased from the 5th day after surgery; by the end of the experiment, the decrease reached 2.1–3.9% of the initial level. The content of the γ-globulin fraction on the 5th and 15th days after the operation decreased by 0.2-0.5%, but from the 25th day until the end of the experiment it increased and exceeded the preoperative level by 0.6-1.4 % [fourteen].

Thus, oral administration of mummy for fractures increases the content of protein fractions, as a result of which the osmotic function of proteins increases and metabolic processes of the body, including regenerative ones, improve [14; 21; 22].

Simultaneously with the study of the effect of mummy on the regeneration of the bone tissue of laboratory animals with fractures of tubular bones, many authors tried to trace the hemodynamic changes occurring under the influence of mummy. For this purpose, a comprehensive study of the state of peripheral white and red blood, hemoglobin and sedimentation rate was carried out erythrocytes in injured animals, which is of undoubted interest foreveryday clinical practice. R. Bekiev and E.M. A crane (1965) was administered to rabbits with an experimental open fracture of the 10th right rib every day, starting from the first day after surgery, for 12 days on an empty stomach, a 7% solution of mummy was injected through a tube in an amount of 1 ml / kg [6].

In the preoperative and postoperative period, the amount of hemoglobin, erythrocytes and leukocytes, as well as the erythrocyte sedimentation rate, were determined in all experimental animals. The blood was examined in the morning before feeding at 1, 3, 7, 10, 13, 16, 21 and 28 days after the fracture was inflicted [6].

During the research, it was found that the change in the number of leukocytes and the erythrocyte sedimentation reaction in animals of the experimental group, compared with the control group, are less pronounced. The number of leukocytes in the majority of rabbits in the experimental group increased by 70% on days 3–7 after surgery. Starting from the 10th day, there was a noticeable decrease in their number, by the 16th day - normalization. The erythrocyte sedimentation rate in the experimental group was accelerated in the first week by 2–3 mm / h in 6 rabbits. By the 10th day, it returned to its original value. Changes in the number of erythrocytes and hemoglobin in the control and experimental groups were not detected [6].

The effect of mummy on the blood picture in dogs and rabbits with long bone fractures was studied by A.Sh. Shakirov (1967) [21]. It was shown experimentally that in 74 experimental animals changes in the blood picture towards worsening were observed only at the initial stage of the experiment. In the following days, when taking mummy, negative readings sharply decrease. In most experimental animals, on the 10-15th day after the operation, under the influence of mummy, there are positive changes in the blood picture - an excess of preoperative indicators of the content of erythrocytes, hemoglobin and a less pronounced acceleration of the erythrocyte sedimentation reaction, which did not go beyond the normal range [21].

Research N.M. Madzhidova et al. (1980) showed that in all dogs of the experimental group during the first 10 days after the fracture of tubular bones there was a decrease in the number of erythrocytes, reaching 33.3% in individual animals. Under the action of orally administered mummy, in half of the experimental dogs after the 10th postoperative day, the decrease in the number of erythrocytes stopped and their number increased [14]. In dogs of the experimental group, within five days after the fracture, the hemoglobin content was 15–33% higher than the preoperative amount [14].

The erythrocyte sedimentation rate in the experimental dogs slightly increased, however

acceleration did not go beyond the upper limit of the norm and remained within the preoperative limits [14].

Mineral metabolism is directly related to the processes of bone tissue regeneration. In this regard, many researchers have studied the composition and content of minerals in the blood of laboratory animals with experimental bone fractures. The effect of mummy on the serum calcium content of 25 rabbits with rib fractures was studied by R. Bekiev (1965) [3]. Starting from the second day after the fracture and for 12 days on an empty stomach every day, the experimental animals were injected with a solution of mummy (in the amount of 0.07 g / kg) into the stomach through a tube. The calcium content was determined by the complex metric method on days 3, 7, 10, 13, 16, 21 and 28.

As a result of the research, it was found that in the rabbits of the experimental group on the 7-13th day, the calcium content increased by 1.3-2.4 mg%, which returned to the initial level by 21 days. In the control group, the increase was 0.6-0.8 mg% and reached the initial values by the 16th day [3].

Z.I. Ibragimov (1970) on the basis of the Uzbek Institute of Traumatology and Orthopedics of the Ministry of Health of the Uzbek SSR, the effect of mummy on the content of some trace elements: copper, manganese,iron and cobalt in blood and bone regeneration in rabbits with experimental fractures [7]. It was shown that the introduction of mummy led to a rapid and sharp increase in the level of the studied trace elements in the blood and bone regenerate. Under the influence of mummy, the process of callus consolidation occurred 8–12 days earlier than in the control group [8].

Biochemical research data of A.Sh. Shakirova (1967–1978) [21–23] and N.M.Madzhidova et al. (1980) [14], performed directly in the regenerate in 20 experimental dogs with bone fractures, indicate that by the fifth day after the operation, the calcium content in the blood exceeded the initial value in 65% of the experimental dogs, and by the tenth day - in 50%. By the 25th day of treatment in the dogs of the experimental group, the opposite process began: only 40% of the animals had the calcium content higher than the initial one, and by the 35th day - in 35% [14].

On the 5th day after the operation, 95% of the experimental dogs had a sharp increase in the level of potassium in the blood. In the following days after the operation (15, 25 and 35), the experimental dogs began a gradual (0.70; 0.95; 1.96 mg%) decrease in the potassium content in the blood and its approach to the initial one [14].

By the 35th day after the operation, the initial content of inorganic phosphorus was restored in 25% of the experimental dogs. Thus, the activation of mineral metabolism by the mummy preparation was experimentally shown, which is manifested by an increase in the level of calcium, potassium and phosphorus in the blood of animals by 5 and 15 days after the fracture - during the formation of callus [14].

The beneficial effect of the drug on mineral metabolism in the body is associated, according toA.Sh. Shakirov, with the fact that the mummy, as a powerful biostimulant, enhances physiologicalfunctions of the body, and also promotes the movement of minerals from the mineral depot into the blood, and, consequently, into the area of the fracture [21; 22].

III. The discussion of the results

The results of the conducted information and analytical research were summarized by us in table 2.

It can be seen from the data in the table that the literature describes the results of numerous experimental studies to study the effect of mummy on reparative regeneration of bone tissue, biochemical parameters of blood and mineral metabolism in fractures of bones of various laboratory animals. Despite a significant number of works, all of them are, as a rule, only a discussion of the results of the experiment. For almost all the studies we discovered, the following general drawbacks can be noted, which do not allow us to correctly assess the effectiveness of mummy and the dose-effect relationship: lack of characteristics of the research object - the name of the drug; deposit of raw materials used to obtain the drug; method of cleaning raw materials; concentration of the drug, methods and doses of its administration; models used in the experiment; experiment technique.

It is important to note that all authors are unanimous in recognizing the presence of a pronounced regenerative activity of mummy in experimental bone fractures, regardless of the location.

collection of raw materials and technology for obtaining an aqueous extract from it.

IV. Conclusion

Shilajit from various deposits and its aqueous extracts in the experiment have a pronounced reparative activity in doses from 0.01 to 0.2 g / kg. The results of the conducted clinical studies will be presented in subsequent publications. Evaluation of the effectiveness of mummy from the point of view of evidence-based medicine after clinical studies using standardized samples of dry mummy extract is promising.

table 2

Regenerative activity of mummy preparations in experimental bone fractures

№ п/п	Автор исследования, библиографическая ссылка	Год	Характеристика объекта исследования				Результаты исследований
			Название препарата и его концентрация	Способ введения и дозы	Опытные животные	Место отбора проб мумиё и способ очистки	
1.	В.Н. Исмаилова [9]	1964	мумиё-асиль	нет данных	кролики	не указано	Вызывает образование массивной костной мозоли в среднем через 10,5 дней.
2.	В.Н. Исмаилова [10]	1965	мумиё-асиль	0,01–0,05–0,1–0,2 г/кг	кролики	не указано	Безвредной и эффективной дозой при лечении закрытых диафизарных переломов длинных трубчатых костей является 0,1–0, 2 г/кг. Чем меньше возраст животного, тем активнее происходит регенерация костной ткани. Способствует увеличению содержания щелочной фосфатазы и повышению уровня кальция и фосфора в крови.
3.	Р. Бекиев [3–6]	1965	мумиё	через зонд 7% раствор из расчёта 1 см³ на 1 кг веса	кролики	не указано	Вызывает образование костной мозоли на 8–10 дней раньше у животных опытной группы. Способствует увеличению содержания щелочной фосфатазы и повышению уровня кальция и фосфора в крови.

4.	А.Ш. Шакиров [21–24]	1965-1983	мумиё	перорально с пищей. Разовая доза составляет: - 0,2 г в течение 10 дней; - 0,1 г в течение 25 дней; - 0,1 г в течение 30 дней; - 0,1 г в течение 40 дней; - 0,15 г в течение 20 дней и 0,1 г в течение 30 дней.	собаки и кролики	Средняя Азия	Ускоряет процесс образования костной мозоли и сроки консолидации переломов на 8–17 дней (у собак) и 7–15 дней (у кроликов). Увеличивает содержание щелочной фосфатазы в крови животных. Пероральное введение увеличивает содержание белковых фракций и, тем самым, усиливает осмотическую функцию белков и улучшает обменные процессы. Улучшает картину крови: увеличивает число эритроцитов и значительно повышает содержание гемоглобина. Активизирует минеральный обмен: повышает уровень кальция, калия и фосфора.

№ п/п	Автор исследования, библиографическая ссылка	Год	Характеристика объекта исследования				Результаты исследований
			Название препарата и его концентрация	Способ введения и дозы	Опытные животные	Место отбора проб мумиё и способ очистки	
5.	Н.М. Маджидов с соавт. [14]	1980	мумиё	перорально с пищей. Разовая доза составляет: - 0,1 г в течение 25 дней; - 0,1 г в течение 10 дней; - 0,2 г в течение 10 дней; - 0,15 г в течение 20 дней и 0,1 г в течение 30 дней.	собаки и кролики	Средняя Азия	Ускоряет появление начальных признаков костной мозоли в среднем на 9 дней, слабой – на 15 дней, ясной – на 16 дней, массивной – на 20 дней. Показано, что прием малыми дозами на протяжении длительного периода более эффективен, чем применение больших доз при коротком курсе лечения. Наилучшим стимулирующим эффектом обладает доза 0,15–0,25 г в течение 10 дней. Способствует повышению содержания щелочной фосфатазы в крови травмированных животных. Пероральное введение увеличивает содержание белковых фракций и, тем самым, усиливает осмотическую функцию белков и улучшает обменные процессы. Улучшает картину крови: увеличивает число эритроцитов и значительно повышает содержание гемоглобина. Активизирует минеральный обмен: повышает уровень кальция, калия и фосфора.

6.	Р.М. Хаитов [18]	1965-1968	пилюли из экстракта мумиё	перорально по 0, 15 г в течение 12 дней.	кролики	Зеравшанский хребет, водный экстракт	Улучшает состав крови и нормализует регенеративно-репаративные процессы в костной ткани у облученных животных.
7.	Р.Ю. Омиров [16]	1969-1970	мумиё	нет данных		не указано	Оказывает выраженное стимулирующее действие на все периоды формирования костной мозоли, ускоряет нормализацию биохимических и морфологических показателей крови у животных в условиях хронического воздействия малых доз инсектицидов.
8.	З.И. Ибрагимов [8]	1970	мумиё	нет данных	кролики	не указано	Приводит к быстрому и резкому повышению уровня меди, марганца, железа и кобальта в крови и костном регенерате при экспериментальном переломе.
9.	Р.М. Максудов [15]	1972	мумиё-асиль	нет данных	кролики	не указано	Стимулирует процесс заживления перелома у облученных и необлученных животных.

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