PROSTAGLANDINS AS AN INFORMATION MEANS CONCERNING THE VITAL CHARACTER AND DURATION OF SKIN INJURIES

I. Lazarov, S. Frantzova, T. Ruseva

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Prostaglandins are not hormones but, as it is reported (3), they possess a hormone-like action. Some investigations (11, 12) gave us reason to accept that in tissues no deposits of prostaglandins formed can be stored. Under the influence of various factors (hormonal, nervous, mechanical) by destruction of cell membrane integrity essential fatty acids lose their esters and then prostaglandins are formed (2). Having in mind the ascertained mechanism of their formation namely from the presence of corresponding external to cell stimuli it is evident that the amount and duration of their concentration maintenance will depend on the nature and duration of action of these stimuli. The mechanic factor inflicting skin injury and destructing cell membranes of numerous cells presents a powerful stimulus for sharp and rapid prostaglandin formation in the wound area. Besides it was established that prostaglandins belong to the most initial mediators of the inflammatory process (9). Thus prostaglandins stimulate in practice the rapid advancing of the inflammatory process in the region of injury. The latter itself exerting a various influence on cells in the damaged area maintains conditions for prostaglandin synthesis. In general, the circumstances presented above determine the rapid synthesis in increasing amounts of prostaglandins in the area of injury. The dynamics of the quantitative changes of prostaglandins in the area of injury can be considered an appropriate means for information in the forensic-medical practice with respect to the precise evaluation of the vital character and the duration of skin injuries after inflicting. Scientific publications dealing with similar tasks in the forensic medicine namely about investigation of the quantitative changes of prostaglandins in skin injury regions were not found out in the literature available. The unsatisfactory statement is known that morphological changes as well as results from some biochemical studies (concentration changes of some biogenic amines — histamine, serotonin) etc. in the focus of damage provide certain data to determine the time interval after inflicting of the injury relatively later on (after hours, days) (4, 6, 9, 10, 13, 14).

Having in mind the properties of prostaglandins described we decided to study the quantitative changes of prostaglandin $F_{2\ alpha}$ (PG_F) in wound tissue at different vital and postmortem stages after skin injury.

Material and methods

A total of 70 guinea-pigs with preliminary crew-cut dorsal skin near to the neck were inflicted cut wounds up to 10 cm long. Immediately after injury, as well as on the 10^{th}, 20^{th}, 30^{th}, 60^{th} min, on the 2^{th}, 4^{th}, 8^{th}, 12^{th} and 24^{th} hour after injury 200 mg skin tissue was taken from wound cut surface. Animals were killed in the acute method in series immediately after taking the skin test. Immediately prior to killing the animals at a 3 cm distance to the right of the first wound a second one was inflicted and skin tissue (200 mg) was again taken.

A series of 20 guinea-pigs were killed by mechanical asphyxia — strangulation. They were inflicted 2 cm long cut wounds every hour up to the 6^{th} hour

and then on the 8th, 12th and 24th hour after killing the animals by the method described above. Immediately after every injury 200 mg skin tissue was taken from wound cut surface. Then all the skin tests were examined by using of a biochemical and radioimmunological method for PG_F amount determination proposed by eminent authors (5).

Results and discussion

Immediately after injury inflicted vitally, the mean rate of PG_F in skin tissue was 20.032 ng/g. In skin tissue taken simultaneously from the same wound but stored at room temperature for 30 and 60 min, respectively prior to application of this method (5) PG_F was 47.016 ng/g and 70.267 ng/g, respectively.

When skin tissue was taken later on after vital injury inflicting the mean rates of the amount of PG_F increased statistically significantly as it was demonstrated on table 1. On the 4th hour after vital injury this rate was already at the average 100 ng/g and remained in tissues up to the 24th hour after vital injury.

Table 1

Vital PG values after skin injury in dynamic follow-up (ng/g)

PG values	At the moment of injury	Duration after injury (in min)			
		10	20	30	60
Mean value ($\bar{x}$)	20.032	43.616	45.4514	47.066	71.991
Deviation of the mean value ($\pm\sigma$)	7.815	13.115	5.4583	23.873	7.990
Mean error of the mean value ($\pm m$)	1.895	5.865	2.063	10.676	2.527

$p < 0.001$

$p < 0.05$

$p < 0.001$

$p < 0.001$

When skin tissue was taken from wound inflicted one hour after death of the animal by mechanical asphyxia and analysed immediately after injury PG_F rate was at the average 18.027 ng/g. Table 2 showed that skin tissue in wounds inflicted later after killing the animals possessed decreasing PG_F quantities reaching down to 9.152 ng/g on the 24th hour.

The great PG_F amount (20.032 ng/g) in immediately injuried guinea-pig skin is evidently opposite to previous results reported (1, 8, 12) according to which is mammalian tissues, inc. guinea-pigs, there are no PGs stored. PG formation is induced by concrete stimuli. Such a stimulus is skin injury as in our investigation destructing cell membranes of all the cells in the region of lesion. However, the level of PG_F at the moment of vital injury is only apparently opposite to previous results. As the authors cited point out, after the beginning of the action of the concrete stimulus the synthesis also starts at once and in dependence on the character and duration of influence of the stimulus the quantity of newly-formed PGs rapidly increases at that place. This increase continues

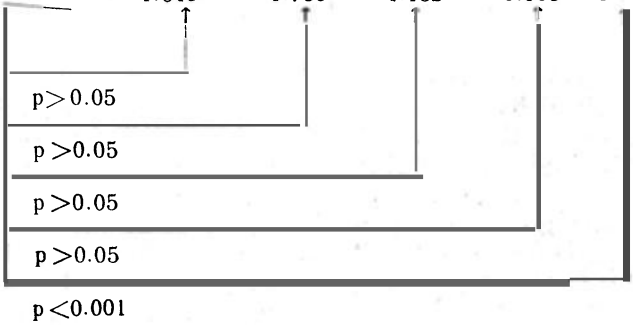
up to the moment when the synthesis is ceased. This can be achieved after disintegration of the tissue studied and extraction of PGs formed. In this method used the extraction is prepared and initiates already during homogenization under the action of ethyl acetate and isopropanol on homogenate. The careful analysis of our technique revealed that 10 min pass after skin injury until the moment of starting the extraction. It is evident that during this period of time PG synthesis continues in the skin tissue studied. Our suggestions are confirmed by the results from experiments on skin tissue taken from wound inflicted immediately prior to killing the animal and stored at room temperature for 30 or 60 min. PG_F rates in this tissue are near to those in wound tissue of vital 30 or 60 min long duration after inflicting. Therefore, these rates concerning skin tissue taken immediately after injury and homogenizated at once present the amount of PG synthesized in the skin tissue at the moment of beginning and realizing of PG extraction. Having in mind that in our investigation we analyse the dynamics of the changes of PG quantity during the periods after skin injury we accept that, with this explanation, we can consider PG_F amounts established initial levels at the moment of skin injury.

As shown on table 1, in the next time intervals until the end of the first hour there are significant differences in PG_F increase in skin tissues from vitally inflicted wounds. These differences (up to the 4th hour after injury) enable us to determine according to concretely ascertained PG_F concentrations in skin wounds during a definite period of time not only the vital character of these injuries, but also the duration after their inflicting.

Table 2

PG values in postmortem skin injury in dynamic follow-up (ng/g)

PG values	Expected values at killing	Duration after postmortem injury (in hours)				
		1	2	8	12	24
Mean value (x)	20.032	18.027	16.676	14.991	12.896	9.152
Deviation of the mean value ($\pm\sigma$)	7.815	6.154	6.020	3,202	2.809	3.015
Mean error of the mean value ($\pm m$)	1.895	1.645	1.738	1.132	0.993	1.066



As demonstrated on table 2, PG_F gradually reduces in skin tissues from wounds inflicted in different periods of time after killing the animals. Initially after death, these rates are very near to those when wounds are vitally inflicted. This fact

as well as the ascertaining of PG_F in postmortem injuries can be explained by the still restored and functioning mechanism of PG synthesis. PG established in injuried skin tissues also after the death of the animal can be reasonable until the moment when there will still be restored cell membrane with suitable lipid fractions available and with enzymes capable to react together to stimuli inciting new PG synthesis.

Conclusions

1. In vitally inflicted skin wounds of guinea-pigs PG $F_{2\alpha}$ amount increases and reaches on the first hour after injury up to 71 ng/g.

2. In postmortem injuries inflicted up to the 8th hour after death the amounts slightly reduce nearly to these in wounds caused in the early minutes before death. In skin wounds inflicted on the 8th—12th hour after death PG $F_{2\alpha}$ mean rates are about 9—12 ng/g.

3. This dynamics of the quantitative changes enables the application of PG $F_{2\alpha}$ for ascertaining of the vital character and duration of skin injuries in the forensic-medical practice.

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ПРОСТОГЛАНДИНЫ В КАЧЕСТВЕ СРЕДСТВА ИНФОРМАЦИИ О ПРИЖИЗНЕННОМ ХАРАКТЕРЕ И ДАВНОСТИ РАНЕНИЯ КОЖИ

И. Лазаров, С. Францова, Т. Русева

РЕЗЮМЕ

У морских свинок исследовались порезные раны на коже в области спины. При этом был использован радиоиммунологический метод выявления простогландинов $Ф_{2альфа}$. При прижизненном ранении устанавливаются нарастающие количества $Ф_{2альфа}$, достигающие к первому часу после ранения до 71 нг/г. В ранах, нанесенных до восьмого часа после умерщвления, устанавливается небольшое понижение количества исследуемого простогландина. Эти количества близки к тем количествам простогландина в ранах, которые наносятся в начальные минуты до смерти. В ранах, нанесенных после 8 го — 12 го часа после смерти устанавливается наличие простогландина $Ф_{2альфа}$ со средними стоимостями — около 9—12 нг/г.

Установленная последовательность в изменении количества простогландина $Ф_{2альфа}$ в ранах на коже, нанесенных прижизненно и после смерти, дает возможность применять исследование этого простогландина в судебномедицинской практике для установления прижизненного характера и давности ранений на коже.