Int J Leg Med (1994) 106:312–314

International Journal of
Legal Medicine

Prostaglandin F_{2a} (PGF_{2a}): an inadequate marker of the vitality of wounds?

C. Hernández-Cueto[1], D. N. Vieira[2], E. Girela[1], E. Marques[2], M. D. Calvo[1], M. Villalobos[3], F. Oliveira de Sà[2], E. Villanueva[1]

[1] Department of Legal Medicine and Toxicology, Faculty of Medicine, University of Granada, E-18071 Granada, Spain
[2] Institute of Legal Medicine, University of Coimbra, 3000 Coimbra, Portugal
[3] Laboratory of Medical Research and Tumoral Biology, Faculty of Medicine, University of Granada, E-18071 Granada, Spain

Received November 9, 1993 / Received in revised form March 11, 1994

Summary. We have studied the viability of PGF_{2a} as a vitality marker in skin wounds. Incised vital skin wounds and homolateral control pieces of skin were obtained from 20 autopsies performed at the Institute of Legal Medicine of Coimbra University (Portugal). We have also studied 10 fresh skin samples from the Department of Dermatology of the University Hospital (Granada). Our results show that PGF_{2a} is not suitable for the diagnosis of the vitality of wounds because of its irregular behaviour.

Key words: Prostaglandin F_{2a} – Skin wounds – Vitality diagnosis

Zusammenfassung. Die Verwendbarkeit von Prostaglandin F_{2a} als Vitalitätsmarker wurde an Hautverletzungen studiert. Als Material dienten 20 vitale Schnittverletzungen sowie entsprechende Kontrollen unverletzter Haut aus 20 Obduktionsfällen des Instituts für Rechtsmedizin der Universität Coimbra (Portugal). Weiter wurden 10 frische Hautproben von Patienten der Dermatologischen Abteilung des Klinikums Granada untersucht. Die Prostaglandin-Analysen wurden mittels RIA durchgeführt. Die Ergebnisse belegen, daß die Bestimmung des PGF_{2a} nicht als Methode des Vitalitätsnachweises von Wunden geeignet ist.

Schlüsselwörter: Prostaglandin F_{2a} – Hautwunden – Vitalitätsdiagnose

Introduction

Prostaglandins are a class of 20-carbon, aliphatic, unsaturated, hydroxylated fatty acids. The several classes of prostaglandins can be identified by differences in the chemical constituents at the cyclopentane portion of the molecule [1]. Prostaglandins are involved in different functions of cellular metabolism, and many publications have appeared during the last few years on a vast and confusing spectrum of pharmacological activities. They have an important role as mediators of functional hyperemia, mediators of inflammatory response, transport of water and electrolytes, relationship with cyclic AMP, etc [1, 2, 6].

It is now well known that prostaglandins play a key supportive role in the development of the inflammatory response. For example, PGE_1 increases vascular permeability in the skin of experimental animals and causes prolonged erythema in normal human cutaneous vessels; PGE_1, PGE_2, PGF_{1a} and PGF_{2a} induce inflammatory responses in human skin; prostaglandin-like substances are associated with the cutaneous reaction in human allergic contact eczema; PGE_2 and PGF_{2a} have been isolated from rat inflammatory exudates. Thus, prostaglandins are released from traumatized cells as mediators of inflammation, and there is evidence for their participation in the wound-healing process locally [1, 2].

Previous reports have indicated that PGF_{2a} is a potential marker of the vitality of wounds, especially the works of Lasarov and collaborators in 1988 [3], where an important increase of PGF_{2a} was found in experimental vital skin cuts in comparison to postmortem incisions.

In spite of the better knowledge of the biology of wounds and acute inflammatory response, the establishment of the vital or postmorten origin of wounds is still a difficult issue in forensic pathology. Nevertheless, a great number of vitality markers have been developed (leucocytic reaction, histamine, serotonin, ions, cathepsin D), and because of this the "Uncertainty Period" described by TOURDES, in which is not possible to differentiate between vital and postmortem wounds, has been substantially shortened [4].

However, there are still many questions to be answered. Our knowledge is limited to incised skin wounds,

Correspondence to: C. Hernández-Cueto

most markers of intra-vital wounds can only be investigated by highly specialized laboratories, we do not know the influence of factors like time of death, cause of death, ambient temperature, place where the corpse was found, etc.

All these reasons have encouraged us to check the potential viability of PGF_{2a} as a vitality marker in human skin wounds.

Material and methods

We have studied 20 incised skin vital wounds from 20 autopsies performed at the Institute of Legal Medicine of Coimbra (Portugal) during 1992. For each vital wound, a control piece of skin was taken from the homolateral part of the body. Samples were appropriately labelled and immediately frozen at −30° C until the investigation in Granada.

We also obtained 10 surgical samples of fresh skin from the Department of Dermatology of the University Hospital (Granada).

A sample of 1 g of skin without subcutaneous fat was homogenized in a mixture of 1 ml 0.01 *M* phosphate buffer, 0.15 *M* NaCl and 3 ml of a solution of ethyl acetate, isopropanol and 0.2 N HCl (3:3:1 v/v/v). To the homogenate 2 ml of ethyl acetate and 3 ml of distilled water were added, which was then stirred and centrifuged to obtain the organic phase, which was dried.

PGF_{2a} analyses were performed using a kit for RIA (INC-STAR^R for PGF_{2a} [^{3}H]), with rabbit antiserum and suitable for PGF_{2a} measurements in serum, plasma and tissues [5].

A calibrated curve was prepared and measured together with the samples. Quantification was performed in a Beckmann LS2800β counter, using a Beckmann Ready Safe cintillation liquid.

Results and discussion

Average PGF_{2a} levels were 39.8 pg/g (± 30.2) in incised vital skin wounds, 96.7 pg/g (± 53.8) in control pieces of skin, and 307.8 pg/g (± 147.9) in fresh skin samples (see Fig. 1).

There was a great variability of the results with high standard deviations, especially for the incised wounds of vital origin. Another point we must highlight is that lower levels of PGF_{2a} were obtained in cadaver specimens in comparison to fresh skin samples from surgical operations. On the other hand, PGF_{2a} levels in incised vital skin wounds were lower than the controls. Nevertheless, we found no statistically significant differences in PGF_{2a} levels between the 2 groups using Student's *t*-test.

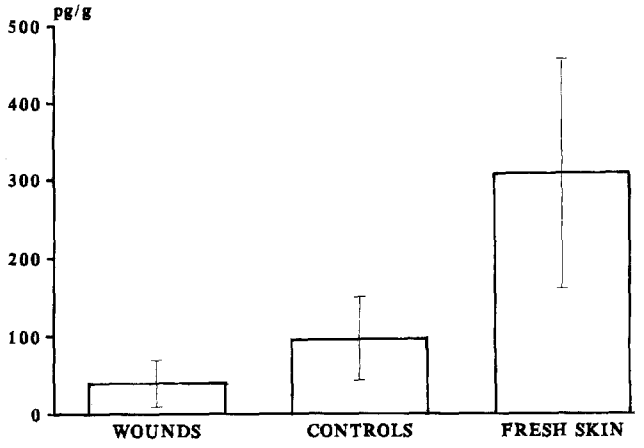

Fig. 1. PGF_{2a} levels in incised vital skin wounds, control pieces of skin and fresh samples, expressed in tissue

All these reasons indicate a fundamental factor which influences the PGF_{2a} levels i.e. the time of death or postmortem interval. The time elapsed between sample collection and sample handling before analysis is critical. As the period of time increases, the sensitivity and specificity of the method become less reliable.

As it has been noticed in the literature with reference to prostaglandins, several tissue phenomena take place after the moment of sample collection e.g. new synthesis of prostaglandins, partial breakdown, conversion between the different classes of prostaglandins, continuation of prostaglandin metabolism, etc [1, 6]. For these reasons it is recommended that the sample extraction must be carried out immediately after collection, and we also need to know the tissue capacity for prostaglandin synthesis and the pattern of prostaglandin-like substances before being able to quantify any class of prostaglandin.

All these facts raise serious doubts about the viability of PGF_{2a} as a marker of the vitality of wounds, and we can summarize the main disadvantages of PGF_{2a} as follows:

1. We need to enlarge our knowledge on the metabolism of prostaglandins in human skin.

2. It is impossible to handle the samples in a moment close to the time of wounding. Unfortunately, routine practice does not reproduce experimental conditions and in most cases there is a postmortem interval before the cadavers are examined by the pathologist (mostly more than 24 hours).

3. In addition to the above mentioned reasons, we have to consider the influence of factors such as: type of wound, location of wound, cause of death, ambient temperature, place where the corpse was found, etc.

4. We also must take into account technical difficulties of the RIA. The laboratory needs a highly specialized equipment and authorization for handling radioactive material.

5. Finally, the high cost of RIA is another disadvantage.

In conclusion, because of the cost, technical difficulties of the RIA, influence of postmortem interval and other factors on PGF_{2a}, we are inclined to think that this biochemical marker is not suitable to study the vitality of cutaneous wounds.

Acknowledgements. This work was supported by a grant of "Acciones Integradas Hispano-Portuguesas, 1992". Ministry of Education and Science, Spain.

References

1. Bookmann RS (1981) Prostaglandins. In: Wadden JW, Stewart WE (eds) The lymphokines. Biochemistry and biological activities. Human Press, Clifton, pp 367–395
2. Hemler ME, Lands WE (1977) Biosynthesis of prostaglandins. Lipids 12/7:591–595

3. Lasarov I, Franzova S, Russeva T (1988) Veränderungen in der Menge des Prostaglandins F_{2a} bei Schnittwunden der Haut mit verschiedener Zeitdauer ihres Bestehens. Z Rechtsmed 99: 273–280
4. Villanueva E, Hernández-Cueto C (1992) Lesiones postmortales: diagnóstico diferencial con las producidas en vida. In: Medicina Legal y Toxicología. Ediciones Científicas y Técnicas S. A., Masson, Salvat, Barcelona, pp 254–261
5. Caldwell BV, Burnstein S, Brock WA, Speroff L (1971) Radioimmunoassay of F prostaglandins. J Clin Endocrinol Metab 33:171–175
6. Piccoletti R, Aletti MG, Ferioli ME, Scalabrino G, Bernelli-Zazzera A (1987) Prostaglandin synthesis and early biochemical events in the liver cells during the acute-phase response. Res Commun Chem Pathol Pharmacol 56/3:291–300