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TRAUMATIC BONE EMBOLISM AS VITAL REACTION

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The early vital signs of injury in the tissues become obliterated with progressing decay. It is the osseous tissue which shows the greatest resistance to changes and effects after death. In spite of this, no data have been found in the literature available that bone embolism would have been used for demonstrating the effect of promptly or fast killing injury. The early vital signs with local bone lesion mentioned by *Panning* [6] in his study cited become wiped out by decay. No reference is made of an entry of damaged bone into the circulation either in the review of *Walcher* [8], or in recent textbooks of forensic medicine or other studies in the field. So far only three data could be found which, however, even their authors mention as incidental findings during the pursuit of other problems. In 1898, *Maximov* [3] examined parenchyma cell embolism in the lungs of rabbits ; in the pulmonary artery of one of the animals killed by destroying the medulla oblongata a bone splinter was found, allegedly originating from an accidental injury of the base of the skull or of the cervical vertebra. *H. Rappaport, M. Raum* and *J. Horrel* [7] studying traumatic bone-marrow embolism in a subject who had suffered from heart disease and had died with spasms found in a section of the pulmonary artery 2 small bone fragments. No reference had been made of a bone lesion. *S. Lindsay* and *H. D. Moon* in 1946 [2] and *J. H. Fisher* in 1951 [1], examining bone-marrow embolism in humans could not find embolized bone ; this fact was especially emphasized by *Fisher*. In the case of *Oltersdorf* [5] (1951) a piece of the hip bone measuring 25 : 19 : 6 mm was dragged by a bomb-splinter into the inferior vena cava. The piece of bone got stuck in the left branch of the pulmonary artery. This case was mentioned as a rarity also by *B. Mueller* [4] in 1953.

Among vital reactions, in the Department of Forensic Medicine in Budapest attention is also paid to eventual early vital signs of bone lesion. Up to now bone embolism has been found in 20 cases where grave fractures had been sustained due to falling, compression or running over. Death had set in promptly or within a few minutes, at most in a quarter of an hour, in consequence of shock, brain injury or loss of blood. In the present paper the fractures shall

not be discussed in detail. Heart and lungs were uninjured, despite fractured ribs. The subjects were examined immediately following death.

Method of examination. After ligating the inferior and superior venae cavae, the thoracic and cervical organs were removed in their original connection. The right half of the heart was rinsed with centrifuged distilled water, after removing the blood. Then, through a cannula introduced into the left auricle, the lungs were rinsed at low pressure in a direction opposite to the circulation. The blood and water removed from the right half of the heart, and those flowing from the pulmonary artery and its branches were collected, haemolyzed with distilled water and slowly centrifuged under continuous washing. The sediment was examined without staining.

Five of the cases examined are reported in the following.

Case 1. Woman, 61 years old, who had thrown herself down from the third floor. Death was »instantaneous«. The skull was smashed to pieces, the brain lacerated, the hip bone and limbs sustained multiple fractures. The ribs were not broken.

Fig. »*A*« : Large splinter of spongy bone found in the right half of the heart.

Case 2. Male, 64 years old, had been run over by a tram. Death had set in a few minutes after the injury. Multiple fractures of the hip bone, fractured vertebrae, grave hepatic injury without abdominal haemorrhage.

Fig. »*B*« : Bone splinter surrounded with adipose tissue from the pulmonary artery.

Case 3. Girl aged 6, had been run over by a tram. The body had been dragged along over a distance of about 150 m. The brain had been found at about 100 m from the place of the accident. Death had set in within a few seconds. Comminuted, open crane, void of its contents, fractured limbs and ribs.

Fig. »*C*« : Two small bone splinters surrounded with adipose tissue, from the right half of the heart.

Case 4. Male aged 40, had been run over by a tram. Death set in 15 minutes after the injury. Multiple fractures of the hip bone and limbs. Chest and head unimpaired.

Fig. »*D*« : Bone splinter from the pulmonary artery.

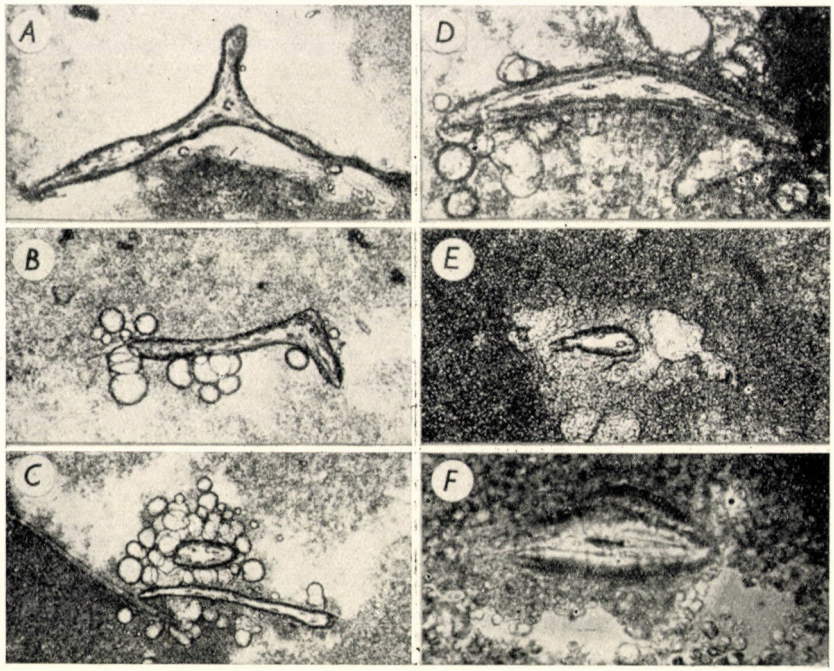
Case 5. Male aged 42, had been compressed between buffers. Death had occurred in 10 to 15 minutes. Multiple fractures of hip bone and femur, of the vertebrae and of several ribs.

Fig. »*E*« : Small bone splinter from the pulmonary artery.

Fig. »*F*« : Single bone cell with Neumann's sheath (cytosteon — »plumstone«) from the right half of the heart of case 5.

In cases 1, 2 and 4 it may be considered impossible, and in the other cases improbable, that bone embolism should have been due solely to outside mechanical force, such as pressure of crushing, independently of the circulation. The structure of the bone emboli, examined under high power, corresponded to that of fresh human bone.

This report is but a preliminary one. Embolism caused by other bone parts, general pathological relations of bone embolism, and multiple technical



and other problems shall be the subject of another report based on the study of more extensive material.

In the light of the examinations made up to now it seems that bone embolism may, even a long time after death, be indication of a bone lesion sustained during life.

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ТРАВМАТИЧЕСКАЯ КОСТНОТКАННАЯ ЭМБОЛИЯ КАК ВИТАЛЬНАЯ РЕАКЦИЯ

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Р е з ю м е

В 20 случаях воздействия тупой силы, ведущего немедленно или через короткое время к смерти и сопровождающегося тяжелыми переломами костей, как например задавливание, падение с высоты, уличные травмы, авторы установили наличие костных обломков микроскопического размера в правой половине сердца и в ветвях легочной артерии.

Метод исследования: Промывание правой половины сердца и легочной артерии дестиллированной водой (промывание легких со стороны левого предсердия) и центрифугирование полученной жидкости. Затем последовало исследование осадка в свежем препарате.

По предварительному мнению авторов оказывается, что эмболия кусочками костной ткани может служить для доказывания прижизненного возникновения данной костной травмы, даже через длительное время после смерти. (Это сообщение является предварительным, исследования продолжаются над большим материялом).