Italian Journal Of Legal Medicine
Bioethics, Medical Jurisprudence, Biopolitics And Forensic Sciences
Vol. 1, number 1, Dec. 2012

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Foreign Body Pulmonary Microembolism Of Building Material. Case Report.

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ABSTRACT

We present a case of foreign body pulmonary microembolism (FBM), observed during a systematic histological review of medicolegal autopsies. In particular, we saw microemboli due to building material in a 62-year old construction worker, found dead under a conveyor belt-roller, with deep erosion on his left forearm and in the left clavear region, subclavian vein laceration, venous aerian embolism and rib fracture. The nature of the foreign bodies was revealed by SEM-DES, through elementar analysis, with detection of Al, Fe, Si, Ca and Ti.

We emphasise the necessity of systematic histological control of medicolegal autopsies, possibly with more extensive and sofisticated investigation and the importance of FBM among topics the causes of death and vital reaction.

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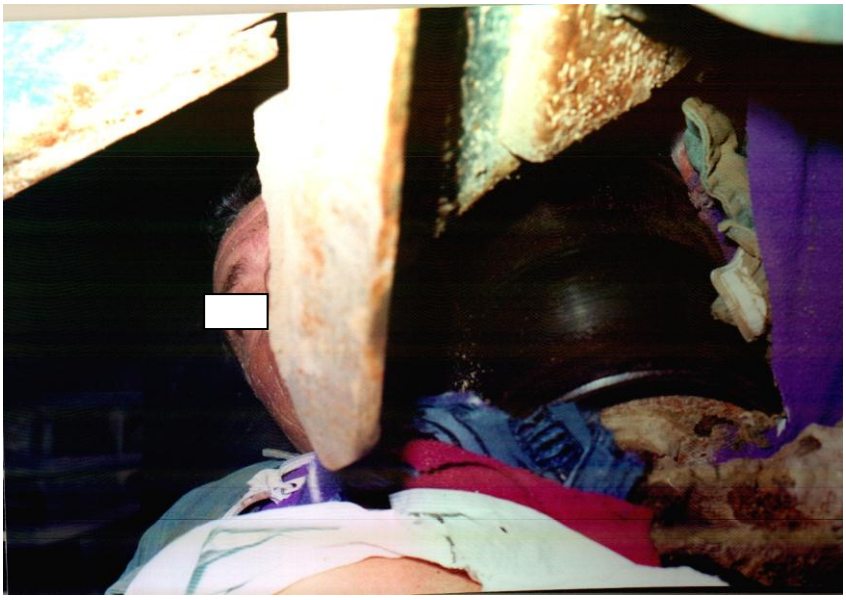
A variety of foreign bodies may be found as emboli during forensic autopsies and histology: shotgun pellets and bullets can enter the circulation and embolise to various sites (Schurr et al. 1996; Yoshiora et al. 1995); particles of talcum can be seen in lungs as contaminants of intravenous drugs and cause foreign body granulomatous arteriolitis; air bubbles enter vessels in case of venous or systemic air embolism (Jorens et al.). If they can only be detected microscopically, the same emboli may be called "foreign body microemboli" (Janssen 1993; Kringsholm 1993). Hence, air embolism is not a true foreign body microembolism, since it is macroscopically detectable.
The following case, although associated with air embolism, is an example of true foreign body microembolism and presents some interesting forensic aspects.

A 62-year old construction worker was found dead at 9.30 a.m. of the 21.1.2000 by a fellow worker, who had seen him alive about an hour before. The

body lay under a conveyor belt-roller, almost sitting on a metal bracket on the right side of the machine, with its trunk horinzontal but twisted under the drive cog-wheel, and its left arm together with the shoulder and part of the base of the neck – wedged between the rubber converyor belt and its roller.

1: General view of the machine. On the left: the heap of building material.

2: The conveyor belt-roller of the machine.



3: the body is struck with its left shoulder between the rubber conveyor belt and its roller.

At autopsy (no 12.097 of Pavia Legal Medicine Department): traces of burnt clothes at friction points. External examination: wide abrasion to the left cheek; long and deep skin and muscle (trapezius) wound, with bruised and partially burned edges, between the neck and shoulder, splitting into two parts: in the left suprascapularis-scapularis region, and in the left fossa supraclavicularis, clavicularis and infraclavicularis regions. Near the wound, there were burned areas with blisters: in one of these, in the left sternalis-mammalian region, there was the impression of a small crucifix worn as a pendant. On the bottom of the wound, the clavicle showed an erosion area, as if the bone had been rasped. A similar, smaller skin-to-bone (radius) erosive area, with skin burning traces, was present on the left forearm.

4: Wound with bruised and burned edges between neck and left shoulder. Impression of a small crucifix (arrow). Note erosion of the clavicle.	5: Left forearm: exposed radius, erosive area.

The section was performed according to Richter's technique for gas-embolism detection. The main findings were: 12 ml gas in the right ventricle of the heart (following chemical analysis: consistent with air embolism); left subclavian vein ruptured at the site of clavicular erosion; left 1-6 ribs fracture along anterior axillaris linie; lungs (r = 550 g; l = 490 g) with subpleural emphysema and with oedema-blood congestion.

6 – 7: Left clavicle after removal: upper and front view.

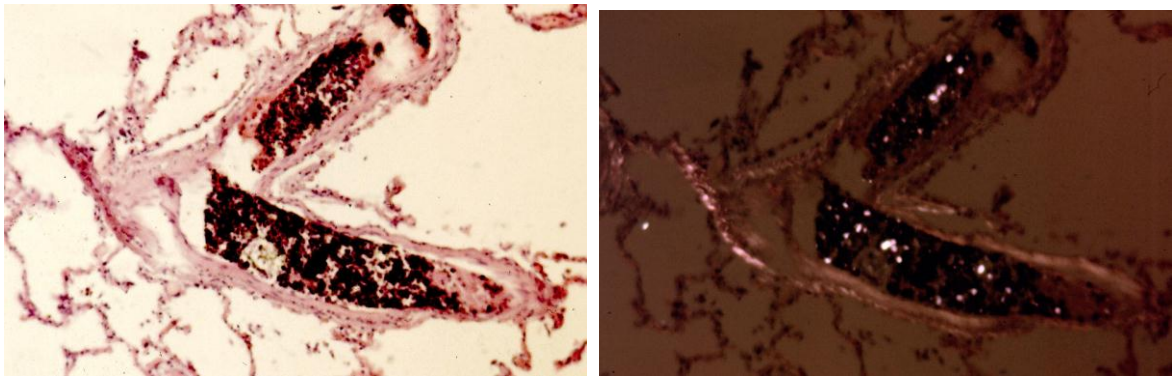
Histological examination (buffered formol fixation; paraffin embedding; H & E) was performed on specimens from all organs, but the main pictures regarded skin, left subclavian vein and lungs.

Skin: complete wound, with bruised and burned edges (blisters; nuclear elongation of basal epithelium); smearing by exogenous, mainly crystal-material.

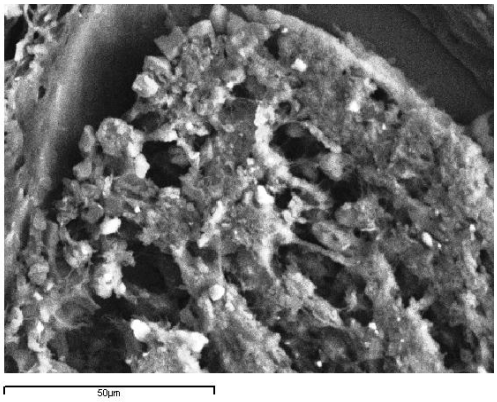
L-Subclavian vein: the wall was broken and bruised, particularly in the laceration recess and in the adventitia.

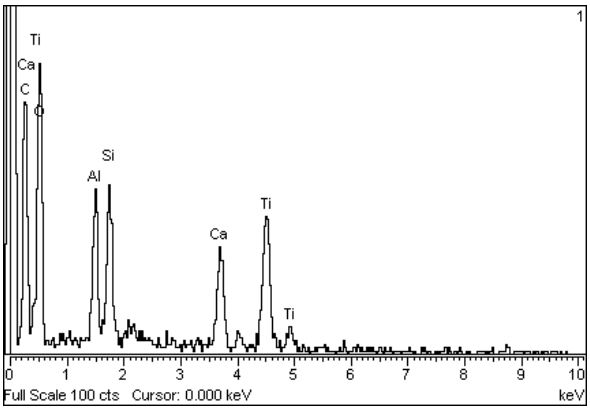
Lung. Many fields of oedema-haemorrhage. Arteriolar and capillar net: showed frequent interruption of the blood column by various images: regularly vacuolar, with haemolytis halo (like fat embolism); clusters of irregular vacuoles, mainly without haemolytic halo; mass as of finely granular substance, containing many birefringent crystals.

SEM-EDS-examination of the lung (thick section on cellophane support or directly on the stub; metallization with golden salts): presence of Al, Fe, Si, Ca, Ti in the exogenous endovasal material.



8 - 9: Branches of a pulmonary arteriola, under standard and polarized light: in the lumen, masses of finely granular substances, containing many bi-refracting crystals. H & E., 240 x.





10: SEM-picture of foreign body microembolism in the lumen of a pulmonary arteriola.	11: SEM-EDS. Spectrum of a foreign particle in the lumen of a pulmonary arteriola: presence, besides C and Ca, of Ti, Al and Si.

Discussion.

SEM elementary analysis by energy dispersive scan (EDS) of the described lung microemboli shows their exogenous nature, derived in particular from building materials crushed by the machine. The phenomenon of foreignbody lung embolism is of great interest in forensic pathology, as a marker of general vital reaction (Janssen 1977).

The crushed material obviously entered the vessel bed through the "entrance door" showed at autopsy, i.e. through the ruptured wall of the left subclavian vein. Because of the particular (negative) blood pressure, at the occurrence of a wound the vessel can act as a suction pump. In this case, the "pump" sucked both air and the building material. Air aspiration in the vein caused the air embolism; this was detected at autopsy with a suitable tecnique, i.e. according to Richter's technique (1905), confirmed at histology and by chemical analysis of the recovered gas.

The solid sucted material came from the conveyor belt and from the roller wheel, whose friction had caused the wound and burns in the left neck-shoulder region and on the left forearm. Probably the victim was caught in the roller wheel and the conveyor belt, while he was checking the functioning of the machine.

FBM and air embolism may have shared with violent asphyxia (thorax compression) in determining death.

The illustrated case represents to our mind a significant example of the importance of systematic histological screening and a successive morpho-analytical search by SEM-EDS correctly and completely to assess forensic-pathological autopsies.

REFERENCES

Bajanowski T., Brinkmann B. (1998) Proof of fatal air embolism. Int. J. Legal Med. 111: 208-211

Bajanowski T., Brinkmann B. (1998) Proof of fatal air embolism after exhumation. Int. J. Legal Med. 112: 2-7

Ghiringhelli R. (1983) L'indagine istologica nella diagnosi di embolia gassosa venosa. Arch.Med.Leg.Ass. 5: 166-175

Janssen W. (1977) Gewebe-und Fremdkörperembolien, in Forensische Histologie, 148-150, Ed. Schmidt-Römhild, Lubeck

Janssen W, (1993) Pathological findings in drugs deaths. Med.Leg.Quad.Cam. 15:159-173

Kringsholm B. (1993) Histological evidence in fatal drug addiction. Med.Leg.Quad.Cam. 15: 175-192

Pierucci G., Gherson G. (1968) Studio sperimentale sull'embolia gassosa con particolare riguardo alla differenziazione fra gas embolico e gas putrefattivo. Zacchia 43: 347-373

Pierucci G., Gherson G., Montagna M. (1967) L'obiettivazione dell'embolia gassosa nel cadavere. Arch.Soc.Lomb.Med.Leg.Ass. 3: 3-10

Pierucci G. (1982) La diagnosi medicolegale di embolia gassosa. Arch.Med.Leg.Ass. Suppl. 41:1-29

Pierucci G. (1985) La diagnosi post-mortale di embolia gassosa. Pathologica 77: 145-155

Pierucci G. (1983) Suicidio per arma da taglio ad applicazione nucale. Quad.Med.Leg. 6: 1-15

Pierucci G. (1997) L'impiego della microspettrometria Raman nello studio delle lesioni da arma da fuoco. Arch.Med.Leg.Ass. 19: 217-232

Pierucci G. (1998) Le embolie, in Giusti G.: Trattato di Medicina Legale e Scienze Affini 2: 89-126, CEDAM, Milano

Richter M. (1905) Gerichtsärztliche diagnostik und technik. Hirzel S. Leipzig 177-178

Schurr M., McCord S., Croce M. (1996) Paradoxical bullet embolism: case report and literature review. J. Trauma 40: 1034-1036

Van Ieperen L. (1983) Venous air embolism as a cause of death – A method of investigation, South Africa Med. J. 69: 442-445

Yoshiora H., Seibel R.W., Pillai K., Luchette F.A. (1995) Shotgun wounds and pellett emboli: case report and review of the literature. J. Trauma 39: 596-