

## **Traumatic Rupture of the Anterior Papillary Muscle**

### **Review of the Literature and Report of a Case**

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**Summary.** A case of traumatic rupture of the anterior papillary muscle is presented. The patient survived for 3.5 h after injury without showing any serious cardiac symptoms, and in the absence of external chest injuries. Cardiac injury should always be suspected after a head-on collision, even if significant symptoms are missing.

**Key words:** Traumatic rupture, anterior papillary muscle – Cardiac injury

**Zusammenfassung.** Der folgende Bericht handelt von einem 21jährigen Autofahrer, der ohne Sicherheitsgurt fuhr. Er erlitt einen frontalen Zusammenstoß und wurde bei vollem Bewußtsein mit multiplen Frakturen der linken Gliedmaßen eingeliefert. Am Brustkorb keine äußerlich zu erkennende Verletzungen. Klinisch nur leichte Hypotonie. Während der ersten Verpflegung verlor er plötzlich das Bewußtsein und verstarb innerhalb weniger Sekunden an Herz- und Atemstillstand. Seit dem Unfall waren 3,5 h vergangen. Obduktionsbefund: Sternalfraktur, Kontusio der vorderen Herzwand, Hämoperikard (100 ml) und Abriß des vorderen Papillarmuskels an seiner Basis. Der Muskel war in die Mitralis umgeschlagen und verschloß zum großen Teil das Lumen der Valvula aortica.

Aus der Literaturübersicht geht hervor, daß isolierte, traumatische Abrisse eines Papillarmuskels äußerst selten sind. In dem einzigen, ähnlichen Fall [17] wurden sehr starke Zyanose und ausgesprochene Hypotonie beobachtet; im vorliegenden Fall fehlte die Zyanose, während die Hypotonie nur leicht war.

Anschnallen hätte wahrscheinlich die schwere Herzverletzung verhindert.

Aus der Literaturübersicht geht zudem die Notwendigkeit hervor, bei Verletzungen durch Verkehrsunfälle besonders nach einer Herzpathologie zu forschen, auch wenn äußere Anzeichen dafür fehlen.

**Schlüsselwörter:** Papillarmuskelabriß, bei Trauma – stumpfe Gewalt, Papillarmuskelabriß

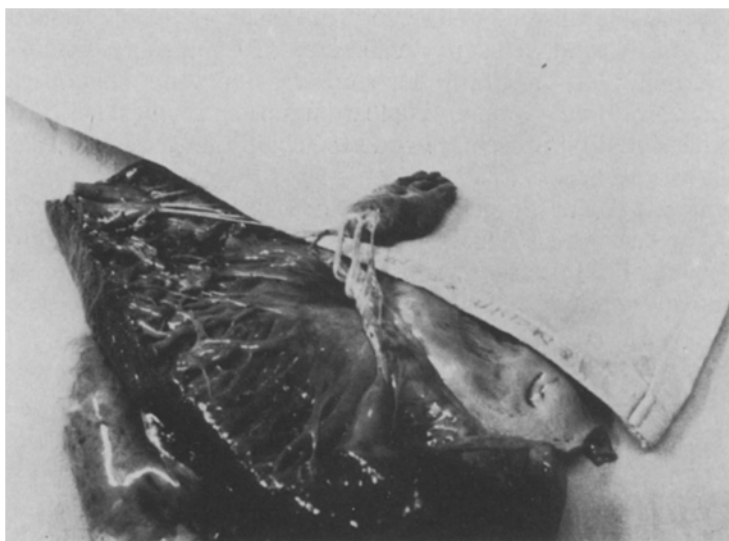
Cardiac disorders arising from traumatic events have become an important medico-legal problem particularly with the increase in high-speed transportation. In fact, while penetrating heart wounds are promptly recognized as depending on trauma, non-penetrating heart injuries are often discovered later, and their etiology is seldom related to the traumatic event [1].

A case of traumatic rupture of the anterior papillary muscle, presenting as an isolated post-traumatic intracardiac lesion, is described. Besides its rarity, this circumstance stresses once again the importance of careful semeiologic examination for the detection of possible cardiac lesions in persons involved in road-traffic accidents.

### Case Report

A 21-year-old healthy man, while driving without a seat belt, was involved in a head-on collision. On admission to the hospital at 0:30 a.m. the patient appeared conscious, with a low blood pressure (maximum 80 mm Hg), and presented an exposed fracture at the left femur and left elbow. While traction of the femur was being performed, a sudden respiratory arrest accompanied by bradycardia was observed, and was followed immediately by complete asystolia. Resuscitative procedures were ineffective, and the patient died at 4:00 a.m.

External inspection of the body revealed a pronounced abnormal mobility of the sternal plate, as well as the fractures mentioned above. At autopsy, an important hemorrhagic infiltration into the anterior perithoracic soft tissues (which appeared uninjured on external examination) was seen, as well as a fracture at the upper third of the sternal body, with laceration of the internal and conservation of the external periosteum. The excised sternal plate could thus be bent to form a right angle. No effusions were observed in the pleural cavities; the pericardium appeared slightly tense, and contained about 100 cc blood. On the anterior heart



**Fig. 1.** Anterior papillary muscle bent into the mitral valve



**Fig. 2.** Almost complete occlusion of the aortic lumen

surface slightly below the coronary groove, there was an enchymatous contused area of about 2 cm with subepicardial extravasation of blood flowing partially into the pericardial cavity with slight leakage from a very small bruise.

The anterior papillary muscle was torn from its implant base, bent into the mitral valve, and displaced upside down into the initial aortic tract, where it determined an almost complete occlusion of the aortic lumen. Within the left ventricle, the zone where the papillary muscle had been disinserted was lined by a fibrin layer, which was also well evident in the corresponding zone of laceration on the papillary muscle. No other lesions were observed in the other body sites, and microscopic examination did not add any further significant information.

## Discussion

In general, papillary muscle rupture is a rare post-infarction complication which usually results in a rapid fatal outcome. Correct diagnosis was not made ante mortem until 1948 [2]. The frequency of this finding at autopsy is 1% in subjects dying of myocardial infarction [3]. De Busk and Harrison [4] reported that 120 cases of post-infarction rupture of the papillary muscles had been described in the literature up to 1969; reports of traumatic rupture are much less frequent, and isolated and solitary traumatic lacerations of the intracardiac structures are exceedingly rare [5]. It is well known [6] that cardiac injuries by blunt violence may be of two kinds. One consists of the damage done by the direct effect of impact, and the other consists of the damage caused by the hydrostatic effects of suddenly increased intracardiac pressure.

Heart rupture occurs mostly in young subjects in whom significant skeletal lesions are not usually observed after contusive chest trauma, because of the

greater elasticity of the bone and cartilaginous structures, whereas visceral lesions, instead, are more severe and often fatal [7].

Rupture of the papillary muscles is a very rare lesion also because it occurs only if the trauma manifests at the beginning of systole (isometric ventricular contraction phase), when the intraventricular pressure reaches highest values; under these conditions, compression of the heart between the thoracic wall and the vertebra brings about such an increase in pressure that the papillary muscles, chordae tendineae or, more rarely, the valve cusps are lacerated [8]. In mitral valve injury papillary muscle rupture or avulsion is the usual lesion [9].

In a group of 27 cases concerning cardiac injuries by blunt chest trauma Giuliani [10] did not observe any valvular rupture. In a series of 61 cases with papillary muscle rupture, Sanders et al. [11] attributed a traumatic etiology to only six. Parmley et al. [1] reviewed the autopsy findings in 546 subjects with cardiac lesions due to non-penetrating contusive trauma and found papillary muscle rupture in 24; the rupture was present as an isolated lesion in only one case, while in the others it was often associated with myocardial rupture. A prolonged survival of 4 months was observed in only one case, which involved rupture of the right papillary muscle.

In 1964, Alexandrow et al. [12] reported another case of right papillary muscle rupture who survived for several days. Longer survival is typical in right papillary muscle rupture [13–16] as compared to similar lesions on the left, where papillary muscle dysfunction, instead, produces more immediate and dramatic consequences. In fact, severe mitral insufficiency with acute pulmonary edema ensue.

Goggin et al. [9] reported a case of post-traumatic mitral incompetence with a long survival which was not caused by papillary rupture but by detachment of chordae of the posterior cusp.

Szakas' case of rupture of the anterior papillary muscle [17] with 9-h survival is very similar to ours. Right from the start, the patient showed symptoms of cardiac failure with intense cyanosis and marked hypotension. In our case, instead, the cardiocirculatory-type symptomatology was not important (hypotension), and was related to hypovolemic shock secondary to the severe concomitant fractures. Only after 3.5 h there was a sudden cardiorespiratory arrest, which was quite compatible with the anatomic-pathologic finding of intra-aortic dislocation of the torn muscle. The muscle was almost entirely lacerated at its implant base and was most likely held within the ventricle by a few flaps, which broke after a few hours, thus determining the immediate intra-aortic dislocation of the lacerated muscular cylinder.

In this case, it is clear that the effects of blunt chest trauma would have been minimized by the use of proper seat belts [18], which in Italy are not yet required by law.

In this report the role played by trauma is obvious. However, it is very difficult to appreciate the correct importance of blunt chest trauma in the etiology of cardiac injury if the heart damage is compatible with a long survival. In this case, it is necessary to both evaluate pre-existing cardiac diseases with accuracy and consider the circumstances of the accidents as well as the acute and long-term symptomatology.

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