

## **Chapter 4**

### **Structural myocardial alterations**

The first 5 sheep that were used in chapter 2 to study the normal ovine electrocardiogram were used to study the normal histological appearance of the Dorper sheep heart.

These sheep were slaughtered and the hearts removed.

#### **Left ventricular dissection**

The musculature of each left ventricle (LV) was dissected into three regions: Two transverse incisions were made, one at the level of the base and the other at the level of the apex of the posteromedial papillary muscle (see figure 4.1). This divides the LV into three regions: base, mid-region and apex. Each of these three regions were then dissected into four parts: anterior, posterior, septal and lateral. In this way every LV was dissected into 12 pieces, representing the musculature of the entire LV, which were subsequently all subjected to histological examination.

These 12 segments were numbered as follow:

A = anterior part of base

B = anterior part of mid-region

C = anterior part of apex

D = septal part of base

E = septal part of mid-region

F = septal part of apex

G = lateral part of base

H = lateral part of mid-region

I = lateral part of apex

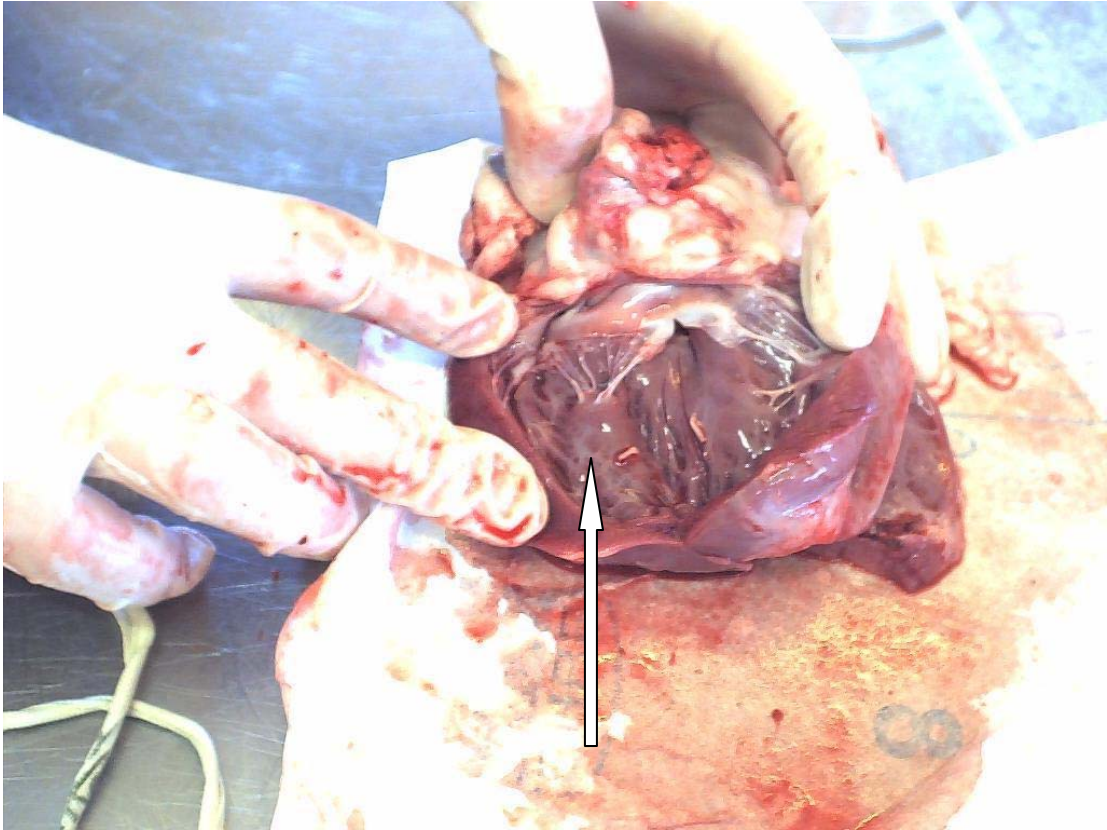
J = posterior part of base

K = posterior part of mid-region

L = posterior part of apex

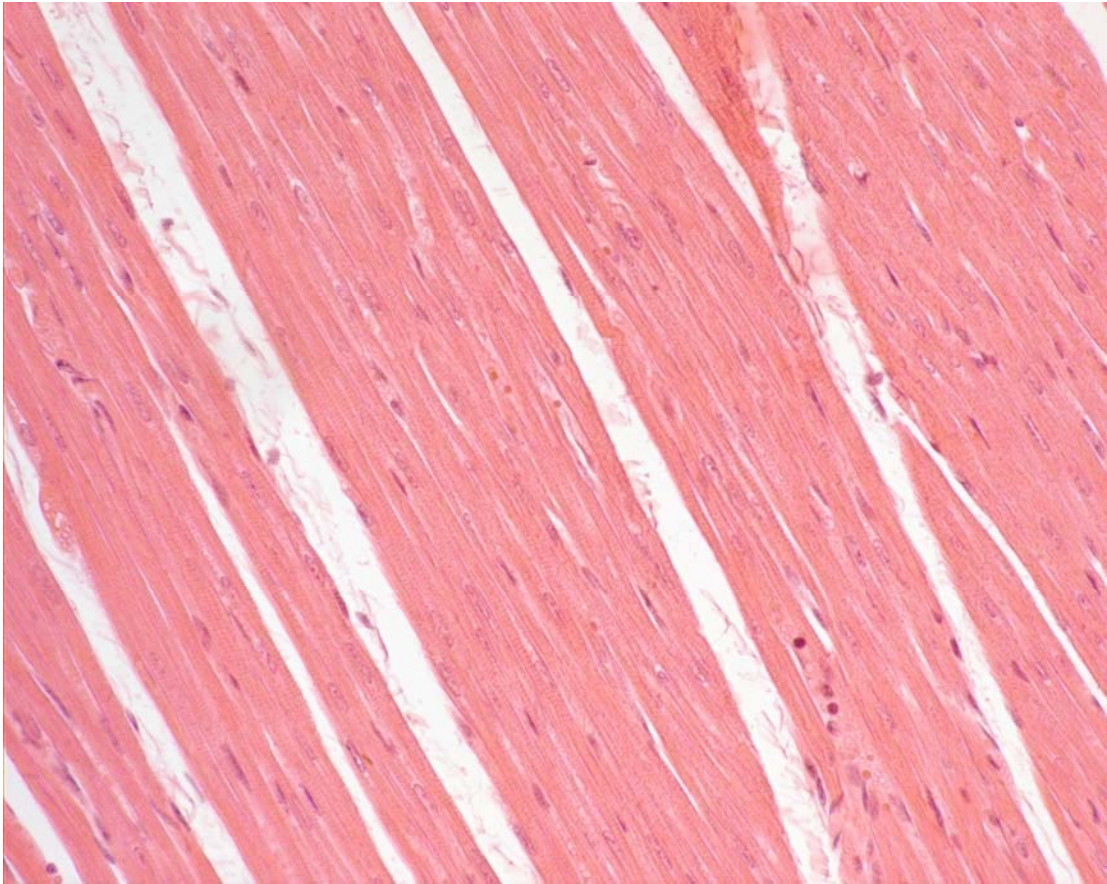
### **Histological evaluation**

Tissue blocks from these 12 sites were fixed in 10 % buffered formalin and paraffin-embedded sections for light microscopy were prepared using routine histological procedures. They were stained with hematoxylin and eosin (HE). All the sections were then histologically examined.



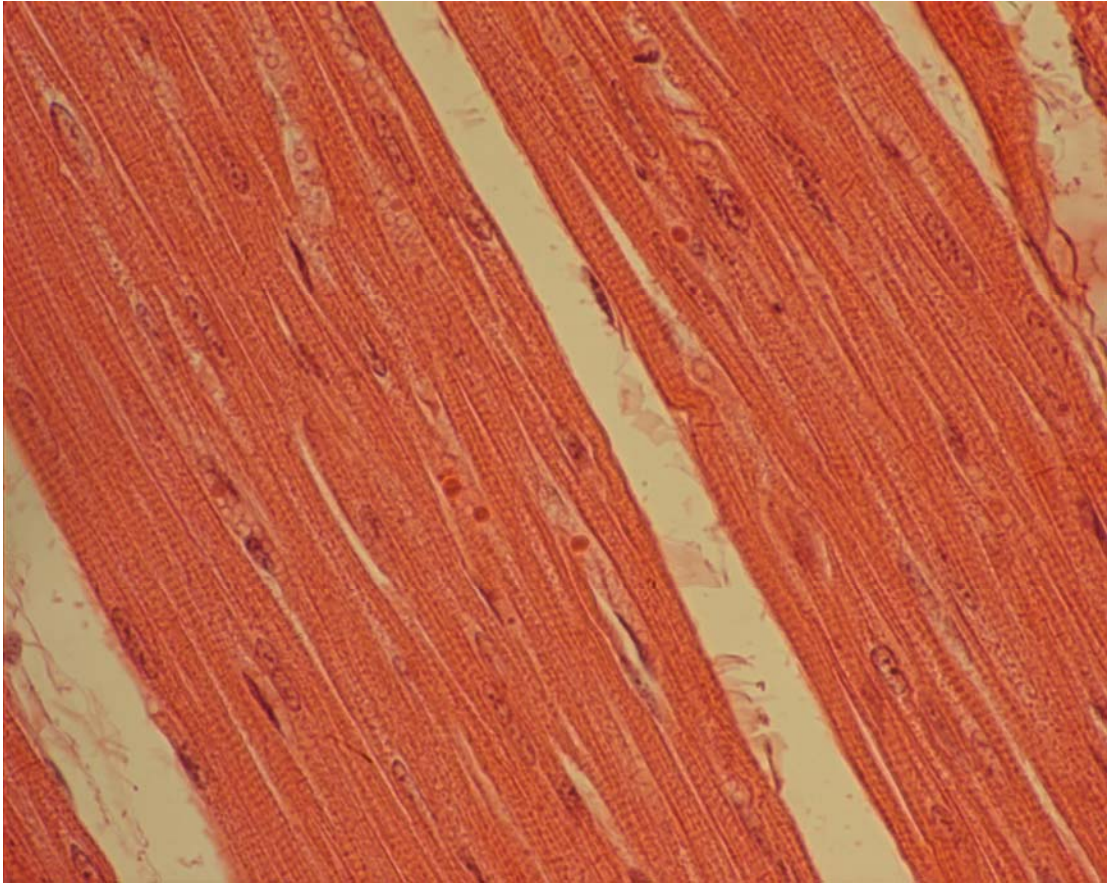
**Figure 4.1.** The posteromedial papillary muscle of the Dorper sheep heart (arrow).

**Myocardial histological appearance of the normal Dorper sheep heart.**

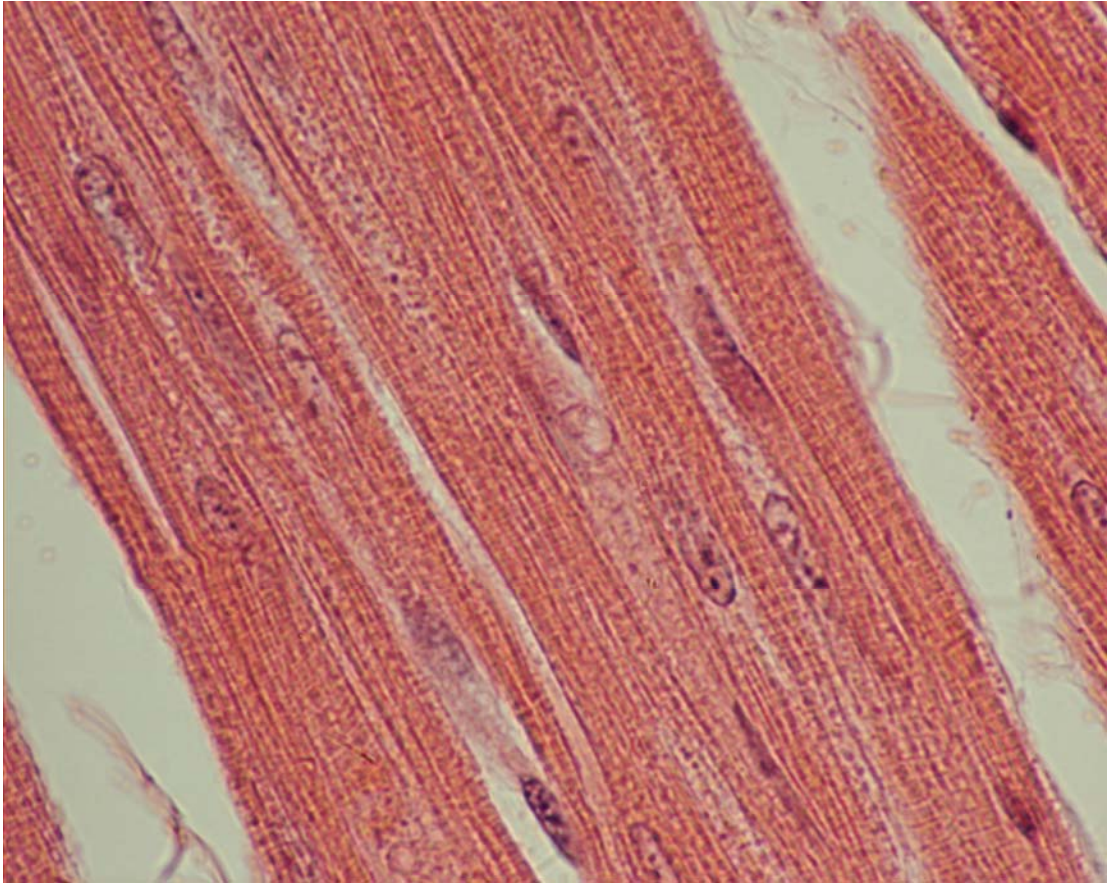


**Figure 4.2.** Longitudinal section (x 100) from sheep 1.



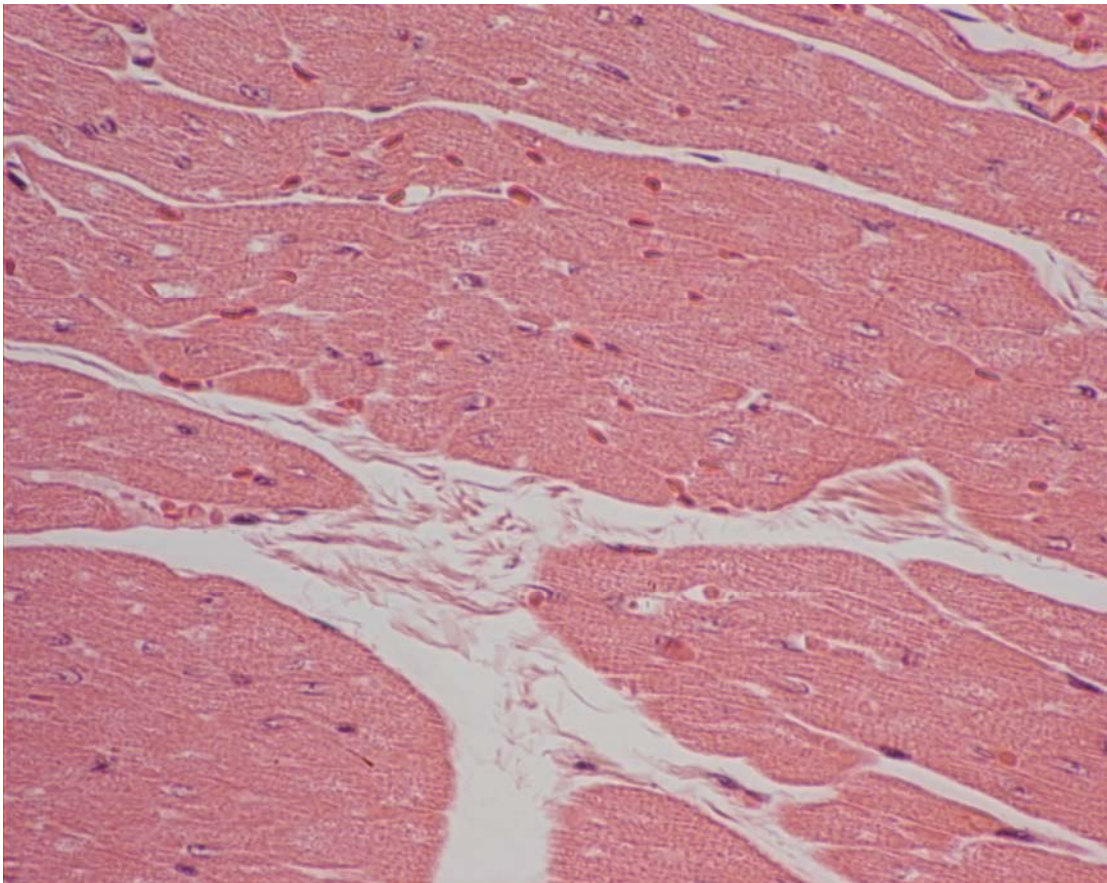


**Figure 4.3.** Longitudinal section (x 200) from sheep 2.

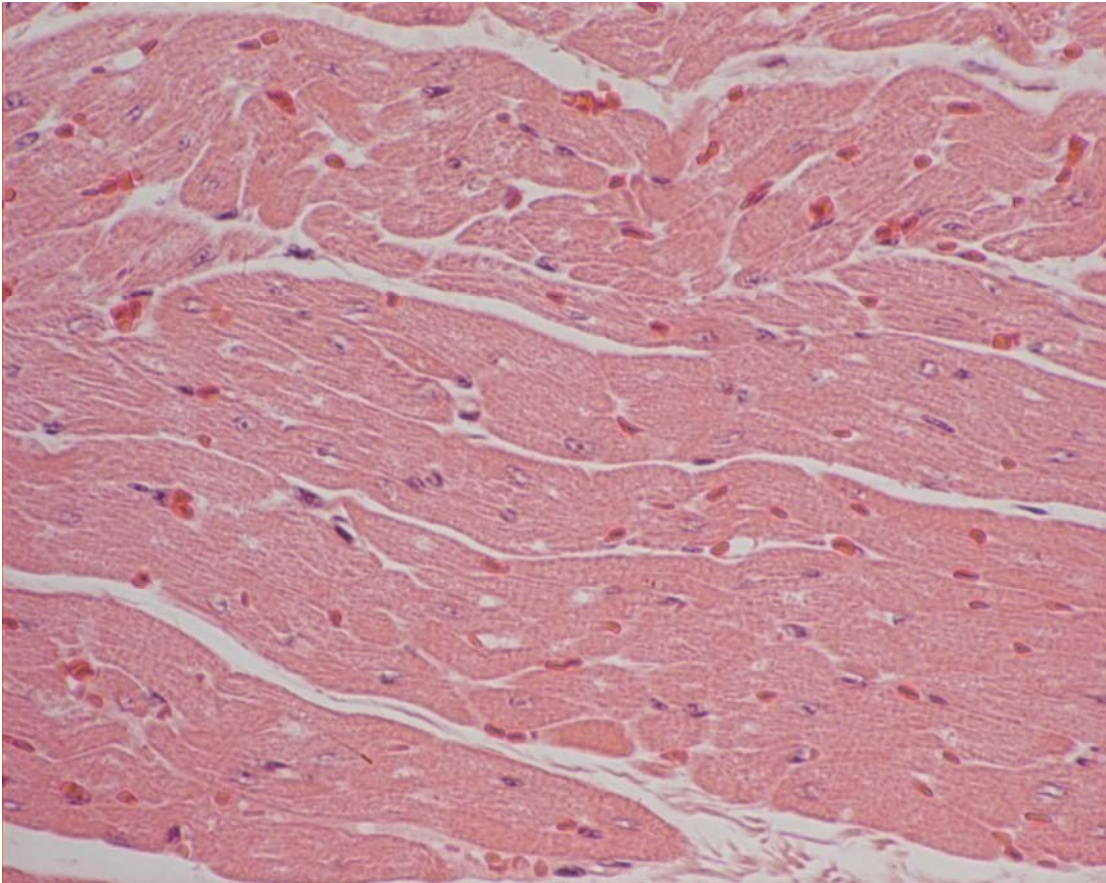


**Figure 4.4.** Longitudinal section (x 400) from sheep 3.





**Figure 4.5.** Transverse section (x 200) from sheep 4.



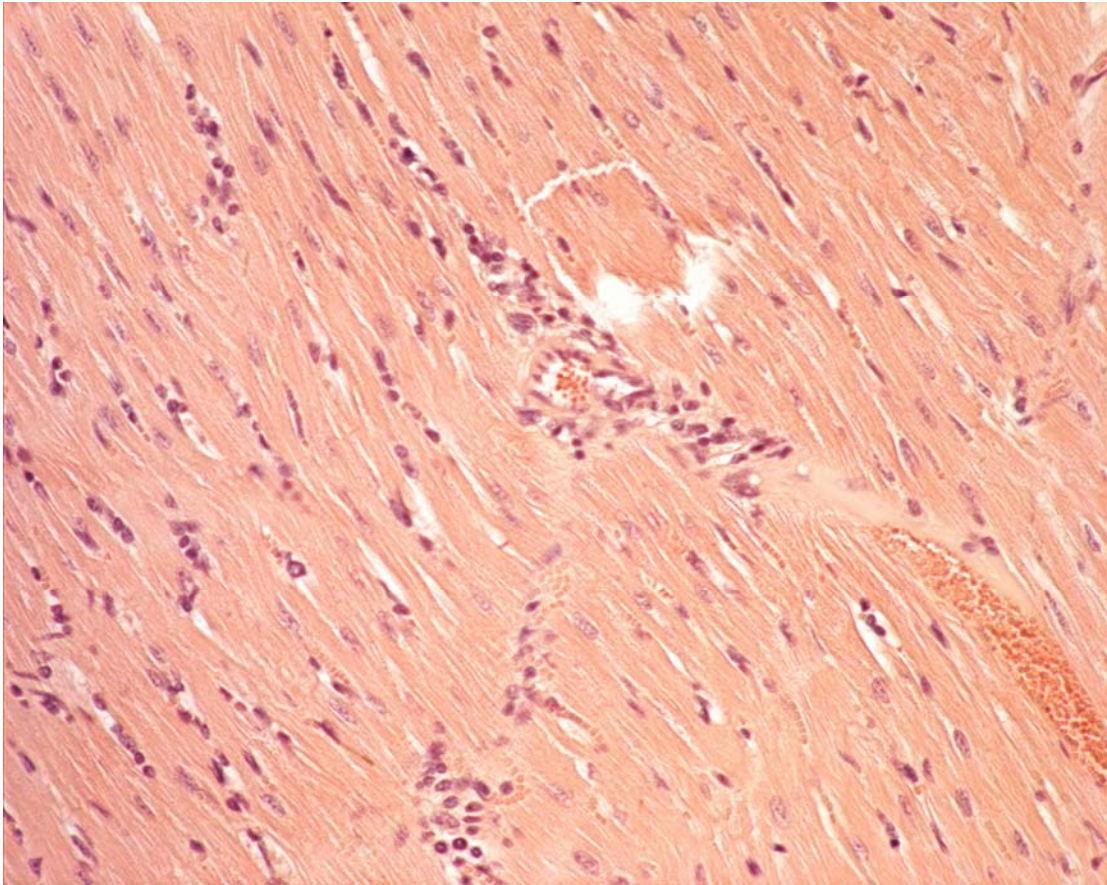
**Figure 4.6.** Transverse section (x 200) from sheep 5.



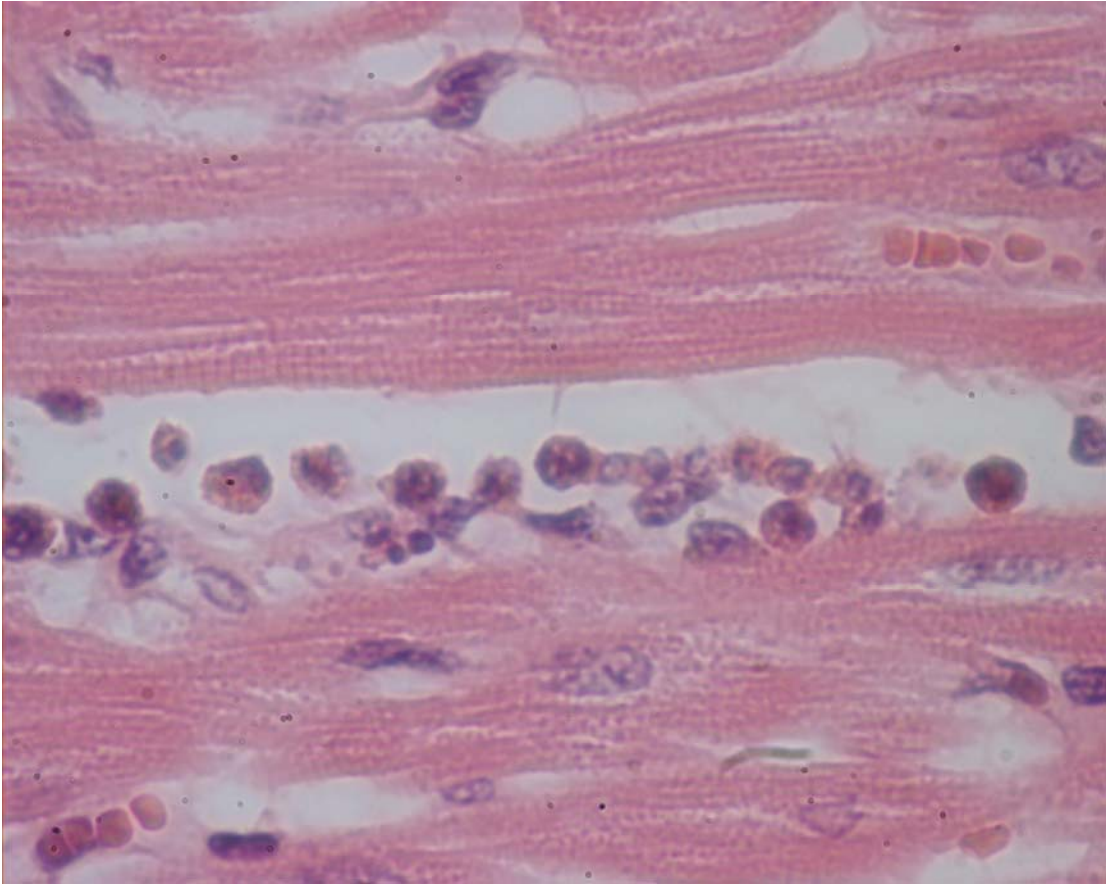
All 12 sections from the left ventricles of all 5 normal wethers had the same normal histological appearance (see figures 4.2 to 4.6).

6 of the 10 wethers that were exposed to prolonged periods of PVC`s were subsequently slaughtered and their hearts were also subjected to histological examination in order to determine if any histological differences exist between the two groups. This was done because of the peculiar finding that the morphology of PVC`s differed between the first and last day of study, findings consistent with possible myocardial pathology, as discussed in chapter 3. Six of these 10 wethers were chosen at random for histological evaluation, the reason for excluding 4 wethers were because of financial constraints. The 6 chosen wethers were: sheep number 2, 4, 6, 7, 9 and 10.

When compared to the 5 histological control animals (see figures 4.2 to 4.6) histological changes occurred in all 6 experimental animals. These changes consisted of both myocardial cellular and interstitial abnormalities (see figures 4.7 to 4.12). According to the Dallas criteria <sup>1, 2, 3, 4</sup> these observed myocardial cellular and interstitial changes are indicative of myocarditis.

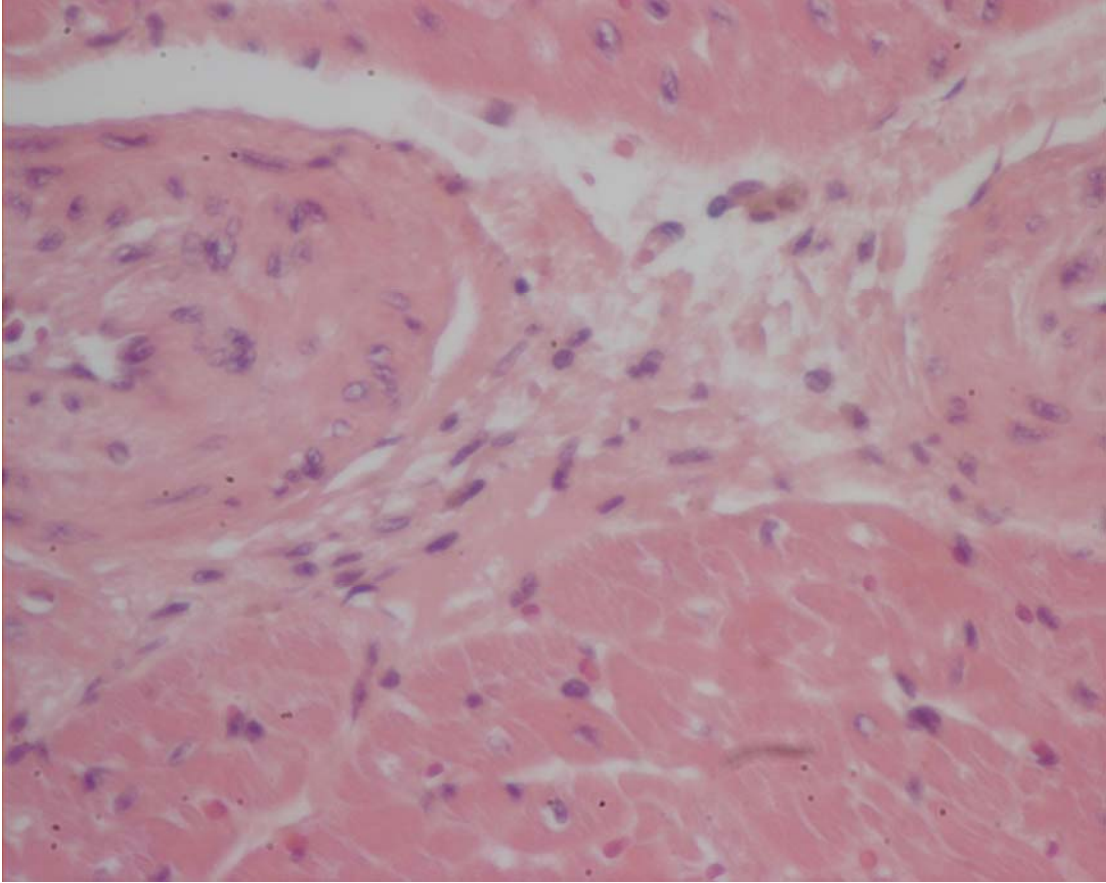


**Figure 4.7.** Longitudinal section (x 100) from sheep 2. Note the infiltration of the left ventricular interstitium by a mixed inflammatory cell infiltrate, a feature of myocarditis.

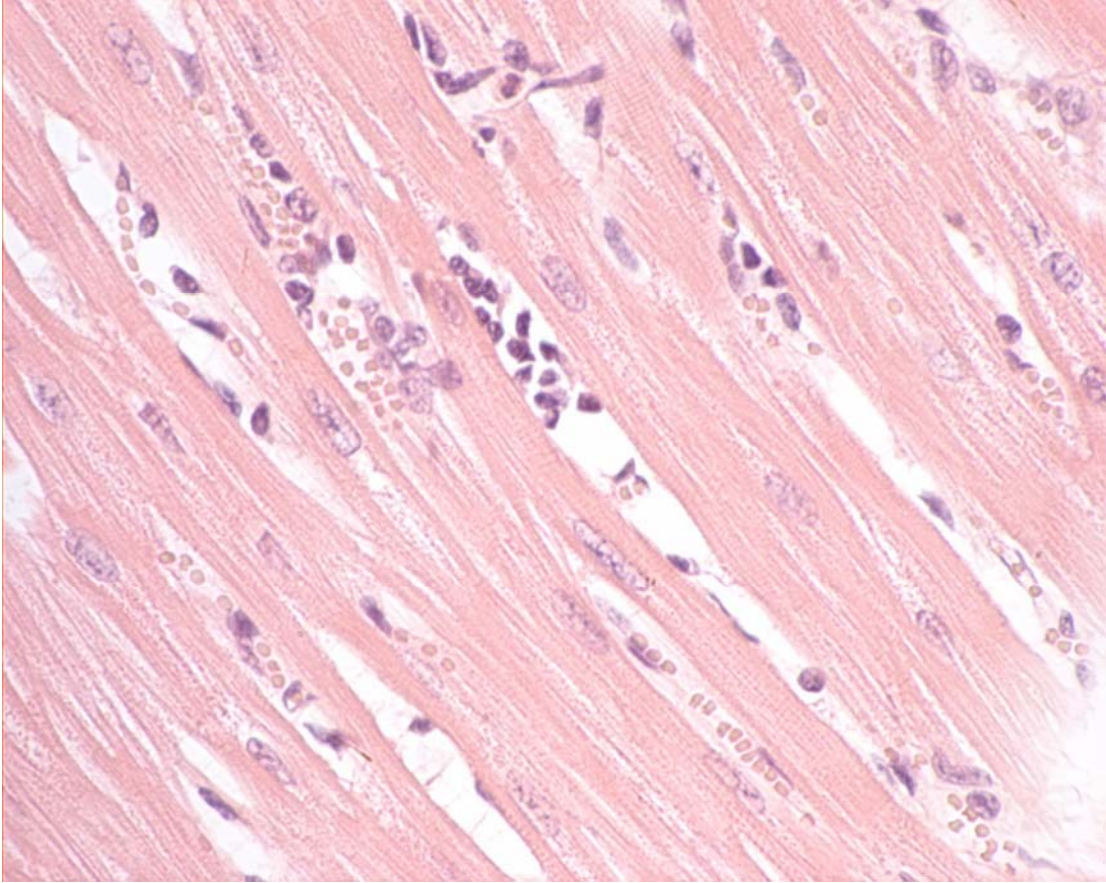


**Figure 4.8.** Longitudinal section (x 400) from sheep 4. Note the interstitial infiltration by inflammatory cells with myocytolysis.

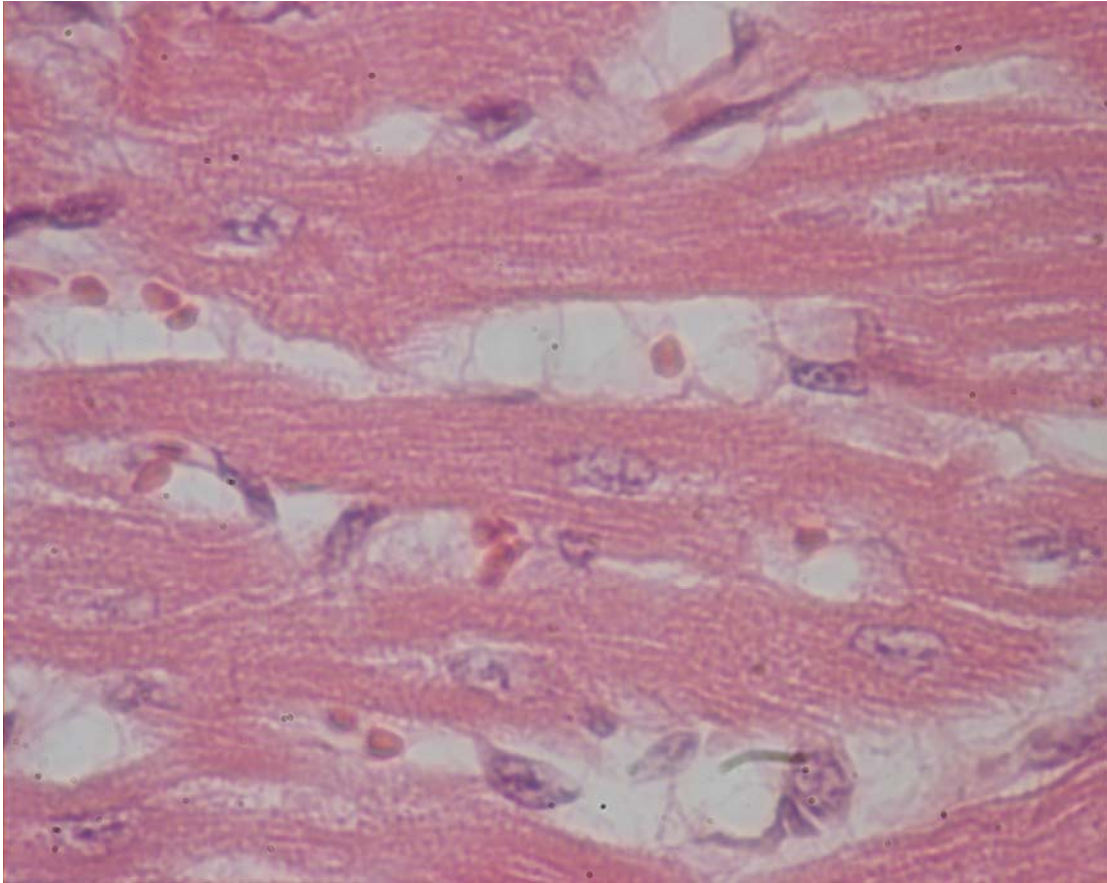




**Figure 4.9.** Transverse section (x 200) from sheep 6. Once again with an interstitial infiltration of inflammatory cells.

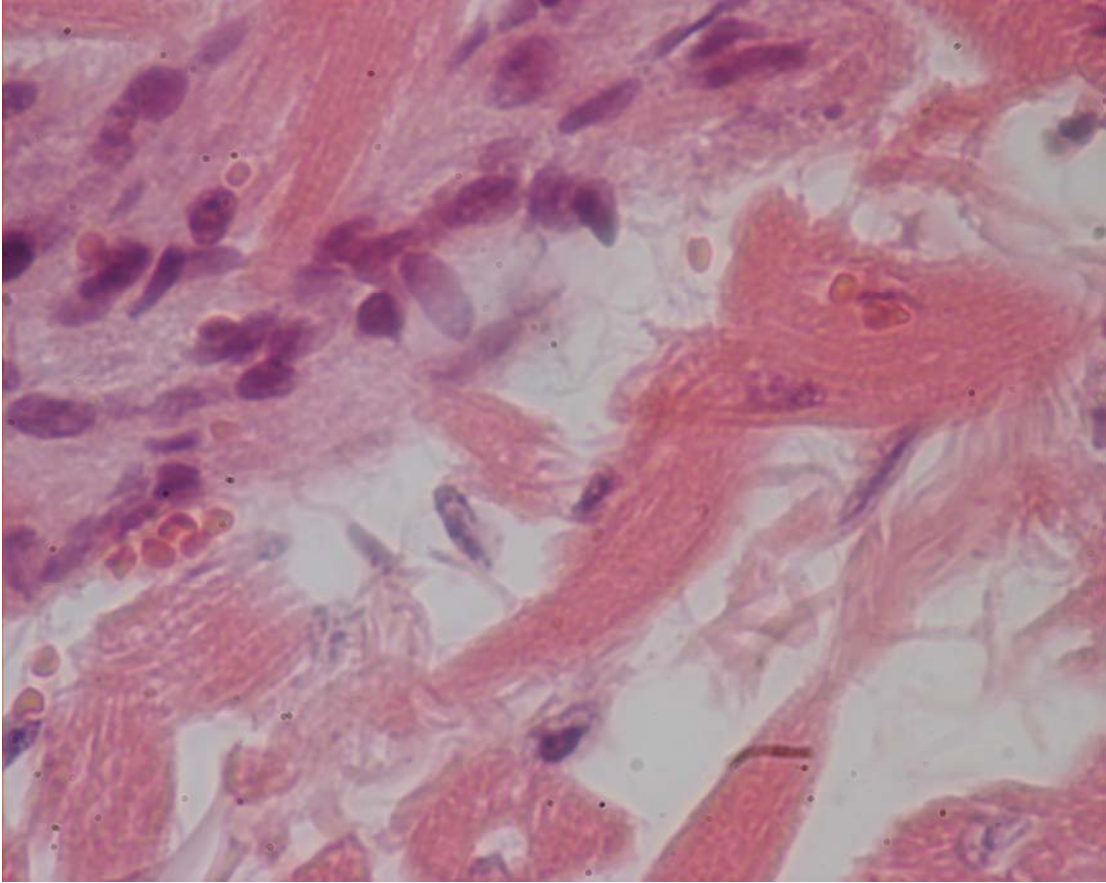


**Figure 4.10.** Longitudinal section (x 200) from sheep 7. Interstitial infiltration of inflammatory cells.



**Figure 4.11.** Longitudinal section (x 400) from sheep 9, demonstrating myocytolysis.





**Figure 4.12.** Longitudinal section (x 400) from sheep 10 demonstrating an interstitial inflammatory cell infiltrate and myocytolysis.

It has thus been shown clearly that in Dorper sheep exposed to prolonged periods of PVC`s, induced by a guidewire situated in the right ventricle, certain morphological changes appeared in these PVC`s, which are indicative of myocardial pathology. As discussed in chapter 3, these changes consist of a prolongation of the QRS complex of PVC`s, the appearance of notching of PVC`s and the disappearance of the ST segment of PVC`s. Every wether served as it`s own control—at the beginning of the study when normal wethers entered the study, the PVC`s had different characteristics than at the end of the study when myocardial pathology was present. This association does not at any stage take the cause of myocardial pathology into account: we are looking at electrocardiographic surrogates of myocardial pathology and thus far, three morphological changes of PVC`s have been found as valid surrogates. The possible causes of myocardial pathology in these sheep will be discussed in chapter 6. Now, we will look if any characteristics of cardiac memory T waves can serve as an electrocardiographic surrogate for myocardial pathology.

**REFERENCES:**

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2. Kühl, U., Noutsias, M., Seeberg, B., Schultheiss, H.P. Immunohistological evidence for a chronic intramyocardial inflammatory process in dilated cardiomyopathy. *Heart* 1996; 75: 295-300.
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