

THE REGENERATIVE CAPACITY OF CARDIAC MUSCLE

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It appears from the work of a number of authors (Fleischer & Loeb, 1910; Christian, Smith & Walker, 1911; Heller, 1914; Karsner & Dwyer, 1916; Collier, 1922; Warthin, 1924; Bright & Beck, 1935; Macmahon, 1937; Moritz & Atkins, 1938; Mallory, White & Salcedo-Salgar, 1939; King, 1941) that there are still differences of opinion concerning the degree of regeneration occurring after damage to cardiac muscle. The following is an account of the findings after diathermy lesions to the rabbit's heart.

In six rabbits the right ventricle was injured by the application of a diathermy needle for 10 sec., causing an area of necrosis 3-4 mm. wide. The animals were killed 24 hr., 3, 5, 7, 9 and 14 days after operation.

At 24 hr. after operation there was necrosis at the site of injury and in a large surrounding area.

At 3 days there was a central core of necrotic cells surrounded by a zone of muscle-cell detritus and fibroblasts containing monocytes, macrophages, lymphocytes and polymorphs.

At 5 and at 7 days the central necrotic zone was smaller and the surrounding zone correspondingly larger. The surrounding zone was composed almost entirely of fibroblasts with hardly any leucocytes. It was being invaded by capillaries from the adjacent undamaged tissue.

At 9 days the central core was largely replaced by new blood vessels and collagenous tissue which had completely invaded the surrounding zone.

At 14 days there was little change from the condition at 9 days. There was very little necrotic muscle left, but on the other hand there was no attempt at regeneration of muscle.

In view of Le Gros Clark's findings (1946) the same type of lesion was made in the gracilis muscle of a rabbit as had been made in the heart (i.e. with a diathermy needle). Ten days after such an injury the gracilis showed clear evidence of regeneration, though there was a large amount of fibrous tissue which appeared to be hindering the growth of the new muscle fibres.

It thus seems that in the rabbit cardiac muscle has not the same regenerative capacity as general somatic muscle.

REFERENCES

- BRIGHT, E. F. & BECK, C. S. (1935). Non-penetrating wounds of the heart. A clinical and experimental study. *Amer. Heart J.* **10**, 293-321.
- CHRISTIAN, H. A., SMITH, R. M. & WALKER, I. C. (1911). Experimental cardiorenal disease. *Arch. intern. Med.* **8**, 468-551.
- COLLIER, W. D. (1922). The adaptive changes of heart muscle. *J. med. Res.* **43**, 207-251.
- FLEISCHER, M. S. & LOEB, L. (1910). Further investigations in experimental myocarditis. *Arch. intern. Med.* **6**, 427-438.
- HELLER, A. (1914). Über die Regeneration des Herzmuskels. *Beitr. path. Anat.* **57**, 223-231.
- KARSNER, H. T. & DWYER, J. E. (1916). Studies in infarction. IV. Experimental bland infarction of the myocardium, myocardial regeneration and cicatrization. *J. med. Res.* **34**, 21-39.
- KING, E. S. J. (1941). *Surgery of the Heart*. London: Edward Arnold and Co.
- LE GROS CLARK, W. E. (1946). The regeneration of mammalian striped muscle. *J. Anat., Lond.*, **80**, 24-36.
- MACMAHON, H. E. (1937). Hyperplasia and regeneration of the myocardium in infants and in children. *Amer. J. Path.* **13**, 845-854.
- MALLOY, G. K., WHITE, P. D. & SALCEDO-SALGAR, J. (1939). The speed of healing of myocardial infarction. A study of the pathologic anatomy in seventy-two cases. *Amer. Heart J.* **18**, 647-671.
- MORITZ, A. R. & ATKINS, J. P. (1938). Cardiac contusion. An experimental and pathologic study. *Arch. Path. Lab. Med.* **25**, 445-462.
- WARTHIN, A. S. (1924). The myocardial lesions of diphtheria. *J. infect. Dis.* **35**, 32-66.