Evidence for Heart Regeneration after Injury in Neonatal Mice

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Background: The human heart muscle has long been considered a terminally-differentiated organ which is unable to regenerate. Recent evidence has challenged this notion, suggesting that the heart regenerates cardiomyocytes following injury, but that this capacity is limited to a short period of time after birth. We aimed to determine whether and how neonatal mouse heart regenerates after myocardial injury.
Methods and Results: One-day-old ICR mice were anaesthetized, the chest was opened to expose the heart, and the apex was resected using iridectomy scissors. Mice were sacrificed 3 days after the operation, and the hearts were harvested, processed, immunostained and compared with normal neonatal and infarcted adult hearts. Histological and immunohistochemical examination of injured neonatal hearts revealed inflammation, granulation tissue formation, and early regeneration at the injured sites. Dedifferentiation of cardiomyocytes, represented by sarcomeric disassembly and marginalization, was evident around the injured areas. In addition, we noticed proliferation of double nuclei cardiomyocytes. The proliferating cardiomyocytes infiltrated the granulation tissue and formed a new myocardium. Interestingly, macrophage collections were found at the border zone of the regenerating myocardium.
Conclusions: Our preliminary findings suggest cardiomyocyte dedifferentiation, proliferation and regeneration in injured heart of neonatal mouse. Furthermore, the increased number of local macrophages, combined with their growth-related effects, suggests a possible active role in the regenerative process. This model could be used to study the mechanism of myocardial regeneration or repair, and to develop new regenerative therapies.