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◇ ORIGINAL ARTICLE ◇

左室心筋伸縮伝搬様式の高時間分解能計測

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抄　録

目的：本研究の目的は多方向からビーム軸上ストレインレート（aSR）計測を行い，左室心筋伸縮伝搬様式を可視化することである．**対象と方法**：同意を得た成人健常例 20 例および 6 例の追試験により検討を行った．スパーススキャンにより高フレームレートを実現して取得した RF 信号に位相差トラッキング法を適用し高時間分解能 aSR 計測を行った．左室長軸断面およびアプローチを変え多方向から描出した左室短軸断面にて aSR を計測した．**結果と考察**：左室長軸断面において左室後壁では拡張後期から等容収縮期に心尖部で生じた収縮が心基部へと伝搬していくことが確認され，すなわち同時相における拡張と収縮の混在が示された．多方向からの左室短軸断面においては収縮期に心基部，中央部では時計回転の収縮伝搬および反時計回転の拡張伝搬が起こり，心尖部ではまず内膜側に収縮が生じ，次いで外膜側から再度内膜側へ起こる強い収縮が観察された．また反時計回転の収縮伝搬および時計回転の拡張伝搬が起こることが確認できた．これらの結果は，局所の心筋伸縮動態は不均一であり，本手法による刺激伝導系ならびに左室固有心筋における伸縮伝搬の可視化を示唆するものである．**結論**：高時間分解能 aSR 計測を多方向から行うことにより局所心筋の伸縮動態に加えて左室の広範囲な心筋伸縮動態の空間的・時間的な不均一性を可視化できることから，本法による心筋伸縮能評価は心臓ポンプ機能解明に有用な情報を与える．

High temporal resolution measurement of propagation pattern of myocardial stretching in left ventricle

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Abstract

Purpose: The objective of the present study is to visualize propagation of myocardial stretching in the left ventricle by measuring the axial strain rate on the ultrasound beam（aSR）. **Subjects and Methods**: Twenty healthy volunteers and six additional cases with informed consent were enrolled in the study. The RF signal was obtained by sparse scan in which high-frame-rate imaging was realized by reduction of scanning line density. Phase differential tracking was applied to the RF signal to obtain high temporal aSR. The aSR of each scanning line was obtained in the left ventricular（LV）long-axis view and multiple LV short-axis views with different scan angles. **Results and Discussion**: The LV long-axis view showed the propagation of the myocardial contraction from the LV apex to the base from the late diastole to isovolumic contraction phase. Thus, both contraction and relaxation were observed in the same cardiac phase. The multiple LV short-axis views showed that clockwise rotation occurred in the systole and anticlockwise rotation occurred in the diastole at the basal and mid portions. The LV short-axis views at the apex showed that contraction first occurred in the endocardium and propagated to the epicardium with strong contraction toward the endocardium. Anticlockwise rotation was observed in the systole and clockwise rotation was observed in the diastole. These results suggested that the contraction of the myocardium was non-uniform, and that the method had potential to show propagation of myocardial stretching in the cardiac conduction system and ordinary myocardium. **Conclusion**: Measurement of high temporal resolution aSR from multiple angles visualized not only local myocardial contraction but also spatial and temporal inhomogeneity of myocardial stretching in the whole heart. Evaluation of cardiac contraction with aSR measurement may provide important information for understanding cardiac pump function.

Keywords

phase differential tracking, propagation of myocardial stretching, axial strain rate on the ultrasonic beam

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