

[HOME](#) | [HELP](#) | [FEEDBACK](#) | [SUBSCRIPTIONS](#) | [ARCHIVE](#) | [SEARCH](#) | [SEARCH RESULT](#)

(*Circulation*. 1995;92:2190-2197.)

© 1995 American Heart Association, Inc.

Articles

Noninvasive Measurement of Tissue Magnesium and Correlation With Cardiac Levels

▶ [Full Text of this Article](#)

▶ Similar articles found in:

[Circulation Online](#)

[PubMed](#)

▶ [PubMed Citation](#)

▶ Search Medline for articles by:

[Haigney, M. C.P.](#) || [Schulman, S. P.](#)

▶ Alert me when:

[new articles cite this article](#)

▶ [Download to Citation Manager](#)

Mark C.P. Haigney, MD; [Burton Silver, PhD](#); Emmanuel Tanglao, MD; Howard S. Silverman, MD; J. Donald Hill, MD; Edward Shapiro, MD; Gary Gerstenblith, MD; Steven P. Schulman, MD

From the Department of Medicine, Division of Cardiology, Johns Hopkins Medical Institutions (M.C.P.H., H.S.S., E.S., G.G., S.P.S.), and the Department of Medicine, Good Samaritan Hospital (E.T.), Baltimore, Md; the Department of Medicine, Division of Cardiology, Uniformed Services University of the Health Sciences, Bethesda, Md (M.C.P.H.); [Intracellular Diagnostics, Inc, Foster City, Calif \(B.S.\)](#); and the Department of Cardiac Surgery, California Pacific Medical Center, San Francisco, Calif (J.D.H.).

Correspondence to Steven P. Schulman, MD, 536 Carnegie Bldg, Division of Cardiology, Johns Hopkins Medical Institutes, 600 N Wolfe St, Baltimore, MD 21205.

Background Intracellular magnesium ($[Mg]_i$) plays an important role in the regulation of myocardial metabolism, contractility, and the maintenance of transsarcolemmal and intracellular ionic gradients. An understanding of the role of magnesium in the clinical setting, however, is hampered by the lack of an assay of intracellular tissue magnesium levels.

Methods and Results We used energy-dispersive x-ray analysis to measure $[Mg]_i$ in sublingual epithelial cells and to correlate the level with those in atrial biopsy specimens from the same patients during cardiopulmonary bypass. Levels were also measured in acute myocardial infarction (AMI) patients before and after intravenous magnesium sulfate administration and compared with those from intensive care unit (ICU) patients and healthy individuals. A strong correlation between sublingual epithelial cell (mean, 32.1 ± 0.3 mEq/L) and atrial tissue (mean, 32.1 ± 0.3 mEq/L) $[Mg]_i$ was present in 18 cardiac surgery patients ($r = .68$, $P < .002$). Epithelial and atrial $[Mg]_i$ levels were lower than in healthy individuals (33.7 ± 0.5 mEq/L, $P < .01$) studied at that time and correlated poorly with serum magnesium. Mean $[Mg]_i$ in 22 AMI patients was 30.7 ± 0.4 mEq/L, which was significantly lower than in 21 ICU patients and 15 healthy individuals (35.0 ± 0.5 mEq/L and 34.5 ± 0.7 mEq/L, respectively, $P < .001$). Intravenous magnesium sulfate was administered to most of the AMI patients (mean dose, 36 ± 6 mmol). $[Mg]_i$ rose

significantly in the AMI patients over the first 24 hours, and the magnitude of the increase was greater in those who received higher doses of intravenous magnesium sulfate.

Conclusions Sublingual epithelial cell $[Mg]_i$ correlates well with atrial $[Mg]_i$ but not with serum magnesium. $[Mg]_i$ levels are low in patients undergoing cardiac surgery and those with AMI. Intravenous magnesium sulfate corrects low $[Mg]_i$ levels in AMI patients. Energy-dispersive x-ray analysis determination of sublingual cell $[Mg]_i$ may expedite the investigation of the role of magnesium deficiency in heart disease.

Key Words: magnesium • myocardium • myocardial infarction

This article has been cited by other articles:

- Shechter, M., Sharir, M., Labrador, M. J. P., Forrester, J., Silver, B., Bairey Merz, C. N. (2000). Oral Magnesium Therapy Improves Endothelial Function in Patients With Coronary Artery Disease. *Circulation* 102: 2353-2358 [\[Abstract\]](#) [\[Full Text\]](#)

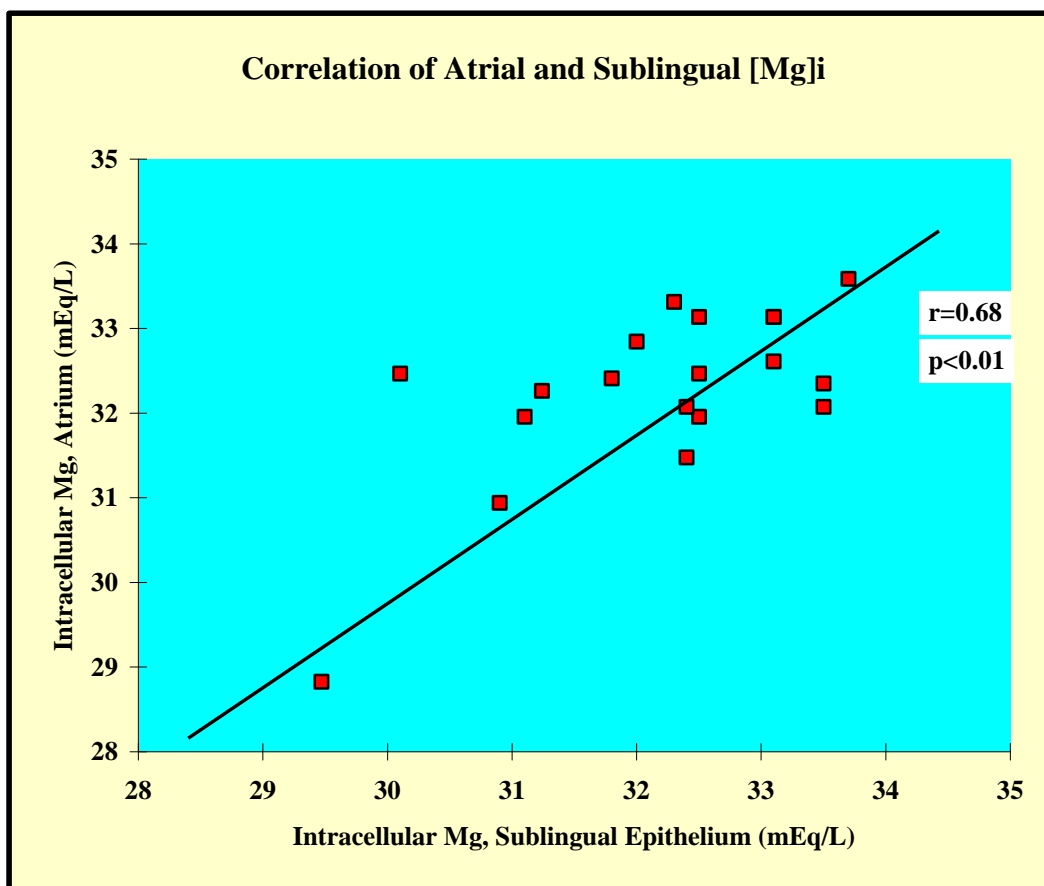
| | | | | | | |
|--------------------------------------|----------------------|--------------------------|-------------------------------------|-------------------------|----------------------------------|-------------------------------|
| HOME | HELP | FEEDBACK | SUBSCRIPTIONS | ARCHIVE | SEARCH | SEARCH RESULT |
| CIRCULATION | | | ART, THRO, VASC BIO | | ALL AHA JOURNALS | |
| CIRCULATION RESEARCH | | | HYPERTENSION | | STROKE | |

[Copyright © 1995 by the American Heart Association.](#)

Correlative Study of Intracellular Magnesium from Atrial Tissues and Sublingual Cells

Atrial biopsy tissues frozen at surgery

Sublingual Tissues Taken within 8 hours of surgery or at surgery



Changes of Intracellular Magnesium in Acute Myocardial patient following Intravenous administration of 0 mmols of MgSO₄, or 1-40 mmols MgSO₄, or > 40 mmols MgSO₄ after 24 hours

