Journal of ANDROLOGY

Search Medline for FREE

HOME HELP FEEDBACK SUBSCRIPTIONS ARCHIVE SEARCH TABLE OF CONTENTS

Journal of Andrology, Vol 21, Issue 6 929-937, Copyright © 2000 by The American Society of Andrology

JOURNAL ARTICLE

The cyclic GMP-specific phosphodiesterase inhibitor, sildenafil, stimulates human sperm motility and capacitation but not acrosome reaction

L. Lefievre, E. De Lamirande and C. Gagnon

Urology Research Laboratory, Royal Victoria Hospital, Montreal, Quebec, Canada.

Capacitation is the series of transformations that spermatozoa undergo in the female genital tract in order to bind to the zona pellucida, initiate the acrosome reaction, and fertilize an egg. Cyclic adenosine monophosphate (cAMP) plays an important role in this process and its levels are regulated by 2 key enzymes, adenylyl cyclase and cyclic nucleotide phosphodiesterase (PDE), the latter being involved in cAMP degradation. Evidence was provided for the involvement of PDE in sperm motility and capacitation. Of the 10 gene families of PDE that exist in mammalian tissues, the calcium-calmodulin-dependent (type 1) and the cAMP-specific (type 4) have been found in human spermatozoa. Using sildenafil, we investigated a highly potent cyclic guanosine monophosphate (cGMP)-specific PDE (type 5) inhibitor and whether this PDE is present in human spermatozoa and is involved in sperm functions. Sildenafil inhibited PDE activity of Percoll-washed spermatozoa with an IC50 of 97+/-3 and 33+/-3 microM when cAMP and cGMP, respectively, were used as substrates. Because the IC50 of sildenafil obtained for PDE type 5 is much lower (2 to 6 nM) than that obtained with sperm PDE, the data suggest that PDE type 5 represents only a small fraction of the whole PDE activity of spermatozoa. Sildenafil causes dose-dependent increases in sperm cAMP levels and capacitation, which are associated with an increase in the levels of tyrosine phosphorylation of 2 fibrous sheath proteins (p105/81). Sperm velocity, amplitude of lateral head displacement, and hyperactivation were increased at 30-180 minutes. Sildenafil did not trigger the acrosome reaction in capacitated spermatozoa. These results suggest that under our experimental conditions, sildenafil triggers human sperm motility and capacitation, probably via its inhibitory action on PDE activity other than type 5 with a resultant rise in cAMP levels.

This Article

Full Text (PDF)
Alert me when this article is cited
Alert me if a correction is posted

Services

Similar articles in this journal
Similar articles in PubMed
Alert me to new issues of the journal
Download to citation manager

Citing Articles

Citing Articles via HighWire
Citing Articles via Google Scholar

Google Scholar

Articles by Lefievre, L.
Articles by Gagnon, C.
Search for Related Content

PubMed

PubMed Citation
Articles by Lefievre, L.
Articles by Gagnon, C.

This article has been cited by other articles:

HUMAN REPRODUCTION UPDATE HOME

C. Jimenez-Gonzalez, F. Michelangeli, C.V. Harper, C.L.R. Barratt, and S.J. Publicover
Calcium signalling in human spermatozoa: a specialized 'toolkit' of channels, transporters and stores
Hum. Reprod. Update, May 1, 2006; 12(3): 253 - 267.
[Abstract] [Full Text] [PDF]

Molecular Biology of the Cell HOME

Y.-H. Su and V. D. Vacquier
Cyclic GMP-specific Phosphodiesterase-5 Regulates Motility of Sea Urchin Spermatozoa
Mol. Biol. Cell, January 1, 2006; 17(1): 114 - 121.
[Abstract] [Full Text] [PDF]

Molecular Human Reproduction HOME

K. Bedu-Addo, L. Lefievre, F.L.C. Moseley, C.L.R. Barratt, and S.J. Publicover
Bicarbonate and bovine serum albumin reversibly 'switch' capacitation-induced events in human spermatozoa
Mol. Hum. Reprod., September 1, 2005; 11(9): 683 - 691.
[Abstract] [Full Text] [PDF]

Molecular Human Reproduction HOME

F.L.C. Moseley, K.N. Jha, L. Bjorndahl, I.A. Brewis, S.J. Publicover, C.L.R. Barratt, and L. Lefievre
Protein tyrosine phosphorylation, hyperactivation and progesterone-induced acrosome reaction are enhanced in IVF media: an effect that is not associated with an increase in protein kinase A activation
Mol. Hum. Reprod., July 1, 2005; 11(7): 523 - 529.
[Abstract] [Full Text] [PDF]

Journal of ANDROLOGY HOME

F. Shi and T. Wang
Stage- and Cell-Specific Expression of Soluble Guanylyl Cyclase Alpha and Beta Subunits, cGMP-Dependent Protein Kinase I Alpha and Beta, and Cyclic Nucleotide-Gated Channel Subunit 1 in the Rat Testis
J Androl, March 1, 2005; 26(2): 258 - 263.
[Abstract] [Full Text] [PDF]

Molecular Human Reproduction HOME

B. Willipinski-Stapelfeldt, J. Lubberstedt, S. Stelter, K. Vogt, A. K. Mukhopadhyay, and D. Muller
Comparative analysis between cyclic GMP and cyclic AMP signalling in human sperm
Mol. Hum. Reprod., July 1, 2004; 10(7): 543 - 552.
[Abstract] [Full Text] [PDF]

BIOLOGY *of* REPRODUCTION HOME

B. Marquez and S. S. Suarez
Different Signaling Pathways in Bovine Sperm Regulate Capacitationand Hyperactivation
Biol Reprod, June 1, 2004; 70(6): 1626 - 1633.

[Abstract] [Full Text] [PDF]

Reproduction HOME

R E Spindler, Y Huang, J G Howard, P Wang, H Zhang, G Zhang, and D E Wildt
Acrosomal integrity and capacitation are not influenced by sperm cryopreservation in the giant panda
Reproduction, May 1, 2004; 127(5): 547 - 556.
[Abstract] [Full Text] [PDF]

Journal of ANDROLOGY HOME

V. Fournier, P. Leclerc, N. Cormier, and J. L. Bailey
Implication of Calmodulin-Dependent Phosphodiesterase Type 1 During Bovine Sperm Capacitation
J Androl, January 1, 2003; 24(1): 104 - 112.
[Abstract] [Full Text] [PDF]

Journal of ANDROLOGY HOME

L. Lefievre, K. N. Jha, E. de Lamirande, P. E. Visconti, and C. Gagnon
Activation of Protein Kinase A During Human Sperm Capacitation and Acrosome Reaction
J Androl, September 1, 2002; 23(5): 709 - 716.
[Abstract] [Full Text] [PDF]

ENDOCRINE REVIEWS HOME

A. Revelli, D. Ghigo, F. Moffa, M. Massobrio, and I. Tur-Kaspa
Guanylate Cyclase Activity and Sperm Function
Endocr. Rev., August 1, 2002; 23(4): 484 - 494.
[Abstract] [Full Text] [PDF]

BIOLOGY of REPRODUCTION HOME

L. Lefievre, E. de Lamirande, and C. Gagnon
Presence of Cyclic Nucleotide Phosphodiesterases PDE1A, Existing as a Stable Complex with Calmodulin, and PDE3A in Human Spermatozoa
Biol Reprod, August 1, 2002; 67(2): 423 - 430.
[Abstract] [Full Text] [PDF]

Molecular Human Reproduction HOME

J.C. Kirkman-Brown, L. Lefievre, C. Bray, P.M. Stewart, C.L.R. Barratt, and S.J. Publicover
Inhibitors of receptor tyrosine kinases do not suppress progesterone-induced [Ca2+]i signalling in human spermatozoa
Mol. Hum. Reprod., April 1, 2002; 8(4): 326 - 332.
[Abstract] [Full Text] [PDF]

Copyright © 2000 by The American Society of Andrology.