Effect of bovine viral diarrhoea virus biotypes on adherence of sperm to oocytes during in-vitro fertilization in cattle

M. Talebkhan Garoussia,a,*, J. Mehrzadb,c

a Section of Theriogenology, Department of Clinical Sciences, Faculty of Veterinary Medicine, Ferdowsi University of Mashhad, Mashhad-Iran
b Sections Immunology and Biotechnology, Department of Pathobiology, Faculty of Veterinary Medicine, Ferdowsi University of Mashhad, Mashhad-Iran
c Biotechnology Research Institute, Ferdowsi University of Mashhad, Mashhad-Iran

Received 12 August 2009; received in revised form 10 November 2010; accepted 12 November 2010

Abstract

Bovine viral diarrhoea virus (BVDV), a member of the Pestivirus genus, is one of the most important pathogens of dairy cattle; it can cause several clinical syndromes, ranging from subclinical to severe disease. The objectives of the current studies were to assess the effects of two biotypes of BVDV on sperm attachment to the zona pellucida (ZP) of oocytes and on fertilization rate in bovine in vitro fertilization (IVF). In two experiments, sperm at two concentrations (10⁵ and 10⁶/mL) and oocytes were incubated with 10⁶ TCID₅₀/mL cytopathic (CP) or noncytopathic (NCP) BVDV. In the first experiment, with the lower sperm concentration (10⁵/mL), male and female gametes were infected with CP or NCP BVDV, whereas in the second experiment, the sperm concentration was 10⁶/mL, and sperm and oocytes were also infected with CP or NCP BVDV. The number of sperm attached to the ZP and the fertilization rate were evaluated with fluorescence microscopy on the ZP of fertile and infertile oocytes. In the first experiment, compared to the control group (n=110), oocytes infected with CP BVDV and incubated at the lower (10⁵/mL) sperm concentration positively affected sperm attachment (n=123) to the ZP of fertile oocytes (P<0.05). In comparison with the control group (n=115), sperm infected with CP BVDV negatively affected sperm binding (n=93) to the ZP of infertile oocytes (P<0.05). In the second experiment (10⁶ sperm/mL), for both fertile and infertile oocyte groups, sperm attachment in the control group was very high and deemed uncountable. However, in treated groups, the number of sperm attached to the ZP was countable. Only sperm infected with CP BVDV negatively affected sperm binding capacity (n=81) to the ZP of fertile oocytes (P<0.05). Although CP and NCP BVDV significantly reduced the fertilization rate of oocytes incubated with a higher sperm concentration, with the lower sperm concentration, only NCP BVDV significantly diminished fertilization rate with contaminated sperm and oocytes (P<0.05). In conclusion, this study supported the detrimental impacts of sperm or oocytes infected with CP or NCP BVDV on sperm attachment to the ZP of bovine oocytes and on fertilization rate during bovine IVF. © 2011 Elsevier Inc. All rights reserved.

Keywords: BVDV; Cattle; IVF; Oocytes; Sperm attachment; Zona pellucida

1. Introduction

Bovine viral diarrhoea virus (BVDV) is a cattle pathogen affecting multiple body systems, with the reproductive system being one of the most seriously affected [1]. Consequences include abortion, reduced conception rate and persistently infected (PI) calves. It is well known that PI cows infected with non-cytopathogenic (NCP) BVDV frequently give birth to PI calves [2]. The NCP biotype, the most common field isolate, does not induce cell death during replication in cell culture, whereas the cytopathic (CP) biotype, a * Corresponding author. Tel.: +98 511 8763851; fax: +98 511 8763852.
E-mail address: garoussi@ferdowsi.um.ac.ir (M.T. Garoussi).

0093-691X/$ – see front matter © 2011 Elsevier Inc. All rights reserved.
doi:10.1016/j.theriogenology.2010.11.015