Spontaneous electrical activity in subpopulation of freshly isolated rat uterine myometrial cells

A. Shmygol, T. Burdyga, R. Duquette, A. Mobasheri*, Camille Vaillant* and Susan Wray

Physiological Laboratory and * Department of Veterinary Preclinical Sciences, University of Liverpool, Crown Street, Liverpool L69 3BX, UK

Many types of smooth muscle including uterus exhibit spontaneous electrical and mechanical activity of myogenic origin. Elucidation of the mechanisms responsible for the uterine autorhythmicity is crucial for the understanding of labour. In recent years, pacemaking in GI tract has been attributed to the activity of interstitial cells of Cajal (ICC) (see Hirst & Ward, 2003 for review). A similar mechanism has also been found in some of the urogenital smooth muscles (Sergeant et al. 2000). In our experiments we found that cells resembling the ICCs’ phenotype are present in the rat and human uterus. These cells, however, did not show spontaneous electrical activity attributable to their possible role as an intrinsic uterine pacemaker. In the present study we have investigated the ability of uterine smooth muscle cells to generate spontaneous action potentials.

Late pregnant (19–21 days) Sprague-Dawley rats were killed by cervical dislocation after CO2 anaesthesia. Single cells were enzymatically isolated from the longitudinal layer of the myometrium and superfused with prewarmed (35°C) Krebs solution. Current clamp mode of the conventional patch clamp technique was used to measure transmembrane potential and to pass polarising current.

Most of the cells examined (26 out of 35) had stable membrane potential of ~64 ± 12 mV (mean ± S.E.M.). All cells were capable of generating action potentials in response to supra-threshold (10–50 pA) depolarising current. The peak value of the action potential was +12 ± 9 mV. Mean duration of the action potential at 90% repolarisation was 86 ± 23 ms. Approximately 25% of cells studied (9 out of 35) were spontaneously active. They generated spontaneous transient depolarisations of 10–20 mV amplitude, which lasted from 1.5 to 4 s. Many of these spontaneous depolarisations resulted in the generation of full sized action potentials with parameters similar to those of the evoked action potentials. Some of the spontaneous depolarisations remained sub threshold and did not lead to the generation of action potentials.

In conclusion, our data suggest that in the uterus, the pacemaking might be an intrinsic feature of smooth muscle cells rather than interstitial cells of Cajal or ICC-like cells.


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