Adrenoceptor Modulated Flow Through the Rabbit Ampulloisthmic Region Studied in vivo and in vitro

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Summary

In adult rabbit does ovulation was induced by human choriongonadotropin (hCG) 48 hours before experiments. At laparotomy the oviducts were cannulated from the ovarian and uterine ends. In vivo as well as in vitro the patency of the isthmus was studied with low viscous fluid perfusion of the ampulloisthmic region in antegrade direction. Intraluminally applied nor-epinephrine (NE) or phenylephrine (PHE) caused dual changes in transisthmic flow; administration of a low dose increased the flow, while high doses decreased the flow in vivo. In vitro, application of PHE only induced a dose-dependent reduction of flow. The PHE-induced reduction of flow was prevented by pretreatment with phenoxybenzamine in vivo and in vitro, suggesting activation of an α-adrenoceptor mechanism. Intraluminal application of terbutaline (T) caused a dosedependent increase of flow, which was most prominent in vivo. Such an increase of flow was prevented by blockade of β-adrenoceptors with propranolol or by selective blockade of β2-adrenoceptors with IPS 399 both in vivo and in vitro, indicating activation of a β2-adrenoceptor mechanism.

The biochemical and hormonal changes 48 hours after ovulation imply a role for the sympathetic transmitter NE in causing a contractile state of the ampullo-isthmic region ("tube locking") for retention of ova prior to nidation in the uterine cavity. The isthmus would then hypothetically act as a sympathetically innervated smooth muscle sphincter. The present results demonstrate a constrictory response of this region to high-dose stimulation of α-adrenoceptors in support of such a hypothesis. However, it must be noted that this region also possesses a population of β-adrenoceptors at this
time interval, which may interfere with a constrictor mechanism via circulating epinephrine.

Key words: oviduct, ampullo-isthmic junction, luminal flow, motility, adrenoceptors, in vivo and in vitro rabbit.

Introduction

The isthmic region of the rabbit oviduct is essential in controlling egg transport from the oviduct to the uterus (Blair and Beck, 1976). After rapid initial transport, the eggs are retained in the ampullo-isthmic region (14–16 hours) before passage into the isthmus with retention for a further 36–42 hours (Pauerstein et al., 1974, Blair and Beck, 1976). This “tube-locking”, a contractile state probably mediated via the adrenergic nerve supply, is important for the timing between the entrance of the zygote into the uterine cavity and the stage of the endometrium. Muscular contractility is thought to be an important factor for propagation of ova, besides secretion and ciliary movements (Anand and Guha, 1987). Control of the isthmic contractility is exerted by ovarian hormones, probably mediated via adrenergic nerves (Coutinho et al., 1971, Helm, 1981), and prostaglandins (Spilman and Harper, 1973, 1975).

In vivo studies of isthmic motor activity in the rabbit have been performed by pressure recordings via intraluminal balloons (cf. Marsafy and Hafez, 1981). The patency of the isthmic segment has also been studied by a perfusion technique in vivo in rabbits by monitoring of the antegrade transisthmic flow, i.e. from the ovarian end to the uterine end (cf. Ström et al., 1981, 1983). In the present study this perfusion technique was used under both in vivo and in vitro conditions to study isthmic patency 48 hours after induced ovulation (hCG). Previous studies in the rabbit have shown a constricted isthmic lumen, high frequency of isthmic contractions of low amplitude and “tube-locking” of eggs at this time interval (Pauerstein et al., 1974, Blair and Beck, 1976, Marsafy and Hafez, 1981). At 72 hours postovulation, when eggs had reached the uterus, isthmic contractility was markedly reduced (Marsafy and Hafez, 1981).

The results of previous in vivo studies of the isthmic region, using the perfusion technique, have suggested that α-adrenoceptors mediate constrictory motor responses, while β-adrenoceptors mediate dilatory responses (Ström et al., 1983). The purpose of the present study was to evaluate the effects of adrenoceptor stimulation on the patency of the ampullo-isthmic region at the time of “tube-locking” (48 hours after hCG) in rabbits under in vivo and in vitro