INDIVIDUAL REPORT

The obtained results clearly support our hypotheses and show increasing intraluminal pressure will cause peristalsis, and the drugs lignocaine, hexamethonium and atropine reduces rhythmic contractility of the ileum in response to a bolus, suggesting that this contraction does indeed have neuronal origins.

This experiment successfully demonstrated that an increase of intraluminal pressure within the guinea pig ileum could result in the peristaltic reflex (figure 1), with increased intraluminal pressure also increasing the amplitude of the rhythmic contractions. This observation confirmed our first hypothesis of increased intraluminal pressure leading to peristalsis, and was expected as the experimental design was a simplified modification of the design by Bulbring, Crema and Saxby (Bulbring et al., 1958).

The perfusion of our guinea pig ileum in lignocaine (M) revealed a 79.3% reduction in ileal contractility and showed smaller and more variable rhythmic contractions superimposed over sustained peristaltic contraction when compared to the standard stimulus trace. Such result have been previously observed in guinea pig ileum preparations (Suzuki and Gomi, 1992). As lignocaine is an antagonist to the voltage-gated sodium ion channel, it is expected to inhibit the depolarisation of neurons and thus with the presence of lignocaine, the amplitude of the guinea pig’s rhythmic contractions was reduced. However, as a high base-line trace was still recorded, this suggests the sustained contraction of ileum is myogenic whereas rhythmic contractions are neurogenic in origin.

The introduction of atropine (M) into the organ bath resulted in a 63% reduction in the magnitude of contraction in the ileum. However while the muscle still exhibited rhythmic contractions in response to the bolus, its magnitude was largely reduced in amplitude compared to the standard response trace, which have been replicated previously on hamster ileum (Shiina *et al*., 2005) and guinea pig distal colon (Smith *et al*., 2003). As atropine is an antagonist of the muscarinic acetylcholine receptor, which blocks excitatory transmission of neurons within the myenteric plexus to smooth muscle, this result again suggests that the rhythmicity of contractions within the guinea pig ileum is due to the activation and contraction of cholinergic neurons acting on muscarinic acetylcholine receptors.

Hexamethonium partially reduced the amplitude of the rhythmic contractions by 38.3% in response to increased intraluminal pressure within the ileum. Its trace showed similarity to that of lignocaine, characterised by a higher baseline sustained contraction superimposed with rhythmic contractions of smaller magnitude compared to the standard trace in response to the bolus which has been similarly found in hamster ileum (Shiina *et al*., 2005) however whether or not an increased sustained contraction was observed was not noted. A similar experiment conducted in guinea pig distal colon showed no increased sustained contraction (Smith *et al*., 2003). Like atropine and lignocaine, this result may be due to hexamethonium blocking excitatory neurotransmission between enteric ganglia within the myenteric plexus surrounding the ileum. The observed reduction in contractile rhythmicity further lends support to rhythmic peristaltic contractions of the ileum being of neurogenic origin.

In the presence of nicardipine, the contractility of our guinea pig ileum show significantly reduced baseline contraction and no rhythmic contractions. Similar results have been obtained in guinea pig distal colon (Smith *et al*., 2003). As nicardipine is an L-type calcium ion channel blocker, it is possible that all routes of muscle contraction are blocked as calcium ion influx is necessary for any muscular contraction. The reduced sustained contraction of the guinea pig ileum following nicardipine perfusion suggests its origin is possibly through stretch-active calcium channels.

A limitation of our current experiment is the assumption that only the contraction of longitudinal muscle contributes to rhythmic peristalsis. Alternative experimental designs to account for this may be the Flat Sheet Preparation (Brookes et al., 1999) or a horizontal setup with separated oral, anal and stimulation compartments to observe ascending and descending neural projections. Future experiments may also involve the use of neural agonists such as DMPP to conclusively determine the involvement of nicotinic acetylcholine receptors in peristalsis.

From our results, we have observed that increased intraluminal pressure can result in a peristaltic reflex, and lignocaine, atropine and hexamethonium all partially reduced the amplitude of rhythmic contractions in guinea pig ileum. As these three pharmaceuticals all target various components of neuronal transmission, demonstrating that rhythmic contractility of guinea pig ileum has a neuronal origin and is not simply an intrinsic property of the muscle. Additionally, nicardipine was able to reduce all contractile activity, as hypothesised, which suggests peristalsis is a combination of both neurogenic and myogenic activities.

References:

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