

Parameters affecting bowel movement

O. Alqatrawi

Department of Physiology, Collage of Medicine and Medical Sciences, Arabian Gulf University, Bahrain

Presenting author: alqatrawiomar@gmail.com

Corresponding author: alqatrawiomar@gmail.com

Abstract

The large intestine is the last part of the digestive system in vertebrates. Water is absorbed here and the remaining waste material is stored as feces before being removed by defecation. However, in a constipated patient the bowel movements are difficult or happen less often than normal, which will cause difficulty and delay in defecation. The drugs that are used to treat this condition are not very effective.

The aim of this study is to find an effective way to treat patients with a delay or difficulty in defecation.

A mathematical model (in silico) of the colon was constructed to study and explain the effects of dry friction, viscous friction, intraluminal pressure, frequency of peristalsis and diameter of the colon on the bolus. The result of simulation of this model are the following: first, increasing the amount of calcium entering the slow and fast calcium channels will cause a disruption in the bowel movement, so there will be a delay in defecation. Secondly, there is a maximum frequency of bowel movement caused by ICCs, which is 10 stimulations with a two-second interval duration between stimuli. Thirdly, if no electrical pulses such as ICCs and motor neurons reach the smooth muscles of the colon the bolus will move due to the fine motor function of the mechanoreceptors, but it will move in an irregular pattern, so it will delay defecation. In addition, if there are no electrical impulses and no mechanoreceptors, the bolus will move due to the elastic forces but only slowly and with disruption. This fault can be corrected by decreasing the viscous friction. Fourthly, dry friction is a highly effective parameter and the bolus will stop moving if this parameter is increased for specific levels, but at the same time, the motor neurons will fire at their maximum level. Finally, there is a relationship between the diameter of the colon, the diameter of the bolus and velocity. If the diameter of the bolus increases to more than 200% of the diameter of the colon, the bolus will move very fast. On the other hand, if we decrease the diameter of the bolus below 105%, the bolus will stop moving because mechanoreceptors will not fire because there are no stretching forces. Increasing the diameter of the bolus will make the bolus move faster.

In conclusion, slow and fast calcium agonist drugs should not be given to patients who suffer from constipation. Doctors should prescribe a combination of laxative lubricant drugs (mineral oil) and laxative bulk-formation (psyllium, methylcellulose) to have effective results.

Keywords: Computational model, Bolus movement, Intestine, Constipation.