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CODIR: COlon Disease Investigation by Robotic Hydro-colonoscopy

Luigi Manfredi[(1)], Stuart Brown[(1)], Jordan Boyle[(2)], Peter Culmer[(2)], Anne Neville[(2)], Alfred Cuschieri[(1)]and CODIR Research Teams[(1) (2)]

[(1)]The Institute for Medical Science and Technology, University of Dundee, UK

[(2)]School of Mechanical Engineering, University of Leeds, Leeds, UK

Purpose

Colorectal cancer (CRC) is a major healthcare problem with an estimated risk of 0.6% in a lifetime. Colonoscopy screening is the standard procedure to detect colon cancer in the asymptomatic population with a high sensitivity (>90%) and a low false negative rate of 6% for small lesions. Standard colonoscopy with air or gas insufflation however causes patient discomfort and hence requires sedation. Recent clinical reports including a randomized controlled clinical trial have demonstrated that warm water reduces patient discomfort by abolishing colonic spasm and increases the completion rates of colonoscopy. CODIR is a five years project funded by the European Research Council for basic and applied research related to the development of a robotic hydro-colonoscopy (RHC) system to replace flexible colonoscopy with a patient-friendly system for inspection of the colonic mucosa.

Methods

The CODIR system is based on filling the colon with a biocompatible warm liquid through which an autonomous, flexible, tethered robotic platform will ascend to the caecum. As the colonic lumen cannot be completely filled with fluid, the robot has to be designed to move in both liquid and over the undulating, viscoelastic flaccid surface of uncovered sections (especially at flexures) of the colon. The colon preparation will be accomplished using a hydrodynamic system with warm solution of polyethylene glycol (PEG) to avoid muscle spasm. Cavitation induced by external focused ultrasound will be investigated as a means of disintegration/liquefaction of solid fecal cleaning/bowel preparation.

Conclusion

The CODIR project proposes a holistic hydro-colonoscopy mini-robotic platform designed to expedite screening colonoscopy as a one-stop investigation and ensures patient discomfort during the procedure without the need for heavy sedation. The system will provide HD imaging of the colonic lumen, ante and retrograde locomotion, navigation and facility for biopsy of suspect lesions.

CODIR Research Teams:

Dundee: A. Cuschieri, M. Trucco, S. Cochran, S. Brown, S. Wilson, R. Keatch, L. Manfredi, C. Tapia, R. Wang, P. Prentice, S. Coleman, M. Pakleppa, M. Siyamalan.

Leeds: A. Neville, D. Jayne, P. Culmer, J. Boyle, A. Hood, W. Mayfield, Z. Ehteshami, J. Chandler, R. Hewson, A. Nodeh

Acknowledgment: This research project has been supported by the European Commission under the 7th Framework Programme through the ERC-AG-ID1 ERC Advanced Grant Interdisciplinary Panel, project reference 268519.