AUTOMATIC VIRTUAL COLONOSCOPY BASED DIAGNOSTIC DECISION SUPPORT SYSTEM FOR COLORECTAL CANCER SCREENING

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1. Introduction

Colorectal cancer is the second most common cause of cancer death in Hungary as in other industrialized countries. Yearly 6000 people die because of colorectal cancer in Hungary. The development of colorectal cancer from polyps is a slow process and takes about 10 years. Polyps may be treated by a simple endoscopic method, thus the development of cancer may be prevented, but it is not known whose colon hides polyps as it often does not causes symptoms. If a suitable screening examination could select those from the population at risk, who may benefit from polypectomy, the colorectal cancer related death rate could decrease to its third. In Hungary yearly about 500 000 inhabitants over the age of 50 should be screened yearly by medical suggestions and in every 5th to 10th case a polyp could be detected.

For screening colorectal cancer or polyps in symptom free patients colonoscopy or fecal occult blood test may be used. The target population is usually set to people over 50 or 55 years, and repeated examinations are suggested in every ten years. However, because of inconvenience and pain only a small number of asymptomatic patients accept colonoscopy and the examination in a few percent may lead to severe complications, sometimes leading to lethal condition. The offered colonoscopic screening failed success in most centers because of low appearance rate. Occult fecal blood testing is practically useless, because of its poor sensitivity in the detection of precancerous polyps.

CT examination after colonic cleansing is accompanied by minimal patient discomfort and is able to detect 100% of colonic cancers and 75-90% of precancerous polyps. The diagnostic
accuracy is even better if virtual colonoscopy is generated from the data of the same CT examination. For detecting smaller lesion thinner slices are needed, which increases the data set. The evaluation of the 300-600 slices of a typical colon CT examination needs enormous time from the radiologist its computer aided evaluation would yield a great support, even if it was done on a per slide basis. Using virtual colonoscopic software images resembling fiberoptic colonoscopy may be generated by building a volume from the original slices. With a suitable method the whole volume or its given parts (e.g. the internal surface of the colon) could automatically be evaluated, the computer selected suspicious areas could easily be checked by the doctor, the offered diagnosis could be supported or rejected.

The bowel cleansing used for colonic CT examinations in asymptomatic patients, because of certain discomfort may deteriorate the acceptance rate of the examination in itself. If a fecal tagging material taken orally the day before the examination could help the electronic removal of the feces during virtual colonoscopy, the acceptance of the method could be increased drastically.

Although radiation doses used during CT examinations have no considerable consequences on patients of the target population (above 50-55 years), screening examinations should keep dosage as low as it is possible because of societal dose concerns. Decreased dosage related deterioration of signal to noise ratios needs further computational solutions to handle.

2. Goals

The aim of the project is to develop a complex system, which may be the base of a complex alternative screening method for colorectal cancer and preceding conditions.

The system includes:

- a less burdening patient preparation,
- a suitable CT protocol,
- a data transfer panel from the CT data to a PC,
- automated virtual colonoscopic software,
- a fecal tagging algorithm
- a panel handling noisy, low dose CT data,
- a complex volumetric data processing, semi-automatic decision support, image evaluating system.

The development of such a modern system is undoubtedly needed and justified from both professional and social benefit, could yield a solution to colorectal cancer screening. The validation, and cost-benefit evaluation of the method regarding the saved life years is the subject of national healthcare evaluations.