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Evaluation of a radiographer tele-training programme in the interpretation of CT Colonography

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Colorectal cancer is one of the most common, and deadly human cancers. By early identification of suspect lesions, screening has the potential to reduce mortality. Colonoscopy remains the screening gold standard, but “virtual colonoscopy” or CT-colonography (CTC) has been shown to generate encouraging results in polyp detection. CTC could be made more efficient and widely applicable if radiographers were trained to interpret the images they generate. Unfortunately “classical” training programs in which highly-qualified radiologists give radiographers detailed explanations can involve unacceptable increases in radiologists’ work-load.

This paper describes a tele-radiology-based CTC teaching program designed to alleviate radiology work-load and summarizes the results of a practical evaluation of such training programs.
RADIOGRAPHERS AND TUTORS

Five radiographers volunteered to participate in this study. The radiographers had no experience with CTC, and only very basic experience with colonic anatomy and pathology. They however had practical experience with numerous abdominal CT and barium enema examinations.

CTC training of the radiographers was performed by two expert radiologists who had an experience of more than 6000 CTC procedures carried out (with more than 800 procedures validated by optical colonoscopy). The radiologists also had broad experience of the organization of CTC-workshops. The training exclusively focused on the colon and did not consider extracolonic structures.

TRAINING

The training programme consisted of different stages:

1) Workshop
A 3-day workshop was organized in the teaching centre to introduce the radiographers to CTC and to normal and pathological conditions in the colon. The workshop consisted of a mix of theoretical presentations dealing with all technical and interpretational aspects of CTC as well as hands-on sessions. In total, 50 CTC cases were interpreted.

2) Training cases
Seventy-five randomly selected cases were used for further training. In these cases CTC had been performed after incomplete colonoscopy in the local department. The cases were interpreted by the radiographers at a rate of four cases every two weeks over a period of 34 weeks. Colorectal polyps ≥ 6 mm were reported and classified in two size categories (≥ 6 mm and ≥ 10 mm). Tumors were included in the calculations and analyzed as polyps, but were described separately as well. The C-RADs classification system was used [14].

All observers read the examinations independently and were blinded to all clinical findings, the colonoscopic results and each other’s findings.

Image processing and interpretation in the novice department were performed with the use of a CT-workstation equipped with dedicated CTC software and allowing primary two-dimensional and three dimensional reading of the colon.

Polyps were measured with electronic calipers on the two dimensional view and recorded according to the segment (cecum, ascending colon, transverse colon, descending colon, sigmoid colon or rectum)

For each polyp detected, the radiographers annotated the segmental location, the size, the attenuation, the slice numbers per acquisition, and the distance to the anal margin of the polyp in a report which included a snap shot per polyp.

3) Test cases
Finally, the radiographers underwent a test series of 20 cases validated by optical colonoscopy. This test was drawn up by the teaching centre and consisted of five normal cases and 15 cases with colonic polyps. There were a total of 27 polyps > 6 mm with 12 and 15 polyps 6-9 mm and > 10 mm, respectively.

The cases were interpreted by the radiographers at a rate of four cases every two weeks over a period of 10 weeks.

RESULTS

Training cases
The training cases had 69 polyps > 6 mm, with 47 and 22 polyps 6-9 mm and > 10 mm, respectively. The polyps were detected in 25 out of 66 patients (39.4%). Two colorectal carcinomas were detected and were categorized as polyps > 10 mm. The overall per-polyp sensitivity for polyps > 6mm and > 10 mm was 56.3% (95% CI 37.2 – 76.1) and 69.1% (95% CI 33.3 – 99.9), respectively. Overall per-patient sensitivity was 86.4% (95% CI 76.7 – 96.1) for polyps > 6mm. Overall per-patient specificity was 85.4% (95% CI 77.0 – 93.9) for polyps > 6mm.

Overall per-patient PPV was 78.3% (95% CI 64.9 - 91.7) for polyps > 6mm.

Test cases
Overall per-polyp sensitivity was 80.7% (95% CI 69.5-92.0) and 94.7% (95% CI 85.6 -100*) for polyps > 6 mm and > 10 mm, respectively. Compared to the training cases, there was a statistically significant improvement in sensitivity for polyps >6 mm in the test cases. The overall per-polyp sensitivity analysis for polyps >6 mm and >10 mm was 86.4% (95% CI 73.5 – 96.9) and 95.8% (95% CI 87.0-100) respectively. The analysis of the data from the training cases for per-polyp sensitivity showed that there was no significant difference between the radiographers.

Overall per-patient sensitivity was 92.9% (95% CI 83.1-100) for polyps >6 mm. No significant difference was observed between the training cases and the test cases in sensitivity on a per-patient basis. Overall specificity was 64.0% (95% CI 13.1-100*) for polyps >6 mm. Overall per-patient PPV was
Advantages of tele-training

The basic rationale for educating radiographers is that a team of radiographers under the supervision of one radiologist could be helpful when screening for colorectal cancer. This approach reduces radiologist time and procedural costs.

The training method used in our studies was based on mentored supervision with tele-training and had several advantages. It allowed for continuous guidance during the training period and could be considered a virtual fellowship. The radiographers could compare their findings with the reports of experienced CTC-readers. Feedback via e-mail and/or tele-conferences provided a continuous source of information. In this way, the radiographers not only learned the importance of good CTC technique, but they were also, and most important of all were faced with their own interpretational errors. During the group meetings each case was reviewed and an explanation was provided whenever a lesion was overlooked or incorrectly interpreted.

This type of mentored supervision has been considered important for CTC-training in the White Paper on CTC published by the ACR colon cancer committee [10]. Tele-training also allowed the radiographers to integrate the training in normal daily activity and learning the technique on their own workstation.

Limitations of tele-training

The training method had however some limitations. Firstly, the radiographers were tested on only 20 cases with a total of 27 polyps > 6 mm. [It should be noted that however the same number of cases was also used for testing the participants in the ACRIN trial [22].] This means that the radiographers were more alert for polyp detection compared to a usual screening setting with low disease prevalence. Together with the relatively low number of normal cases, this probably explains the low specificity.

In conclusion, this CTC tele-training method proved successful and could have an important and useful role in future training of radiographers in CTC.

REFERENCES

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