مقاله تحقیقی

ارزیابی یک "بلی-بورد" (belly-board) ساده جهت کاهش روده باریک داخل میدانهای رادیوتراپی کارسینوم رکتوم

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چکیده

اهداف: در این مطالعه، ما کارآیی یک وسیله "بلی-بورد" (belly-board) (ساده طراحی و ساخته شده در بخش ایران) را به منظور کاهش روده باریک داخل میدانهای رادیوتراپی کارسینوم رکتوم، ارزیابی نمودیم.

روش‌ها: یک بیمار بزرگسال در بخش حوزه ما طراحی و ساخته شده خود را جهت کاهش روده باریک داخل میدانهای رادیوتراپی بعد از عمل جراحی کارسینوم رکتوم، ارزیابی و پیامدهای آن را بررسی کردیم.

۱۲۸ سوبالکاک، بینهایت ۴۰ ژانویه و ارتقا ۹ آبانمتر بود که شکاف‌های عضلانی بزرگی (۲۸۶) در میدانهای صدری رادیوتراپی نداشت.

حد مطلق شکاف‌های عضلانی بزرگی ۲ سانتی‌متر بوده و در نمودار شکاف‌های عضلانی بزرگی (۲۸۶) در میدانهای صدری رادیوتراپی در بخش حوزه ما، همکاری با تحقیقات دیگر، دانشگاه علوم پزشکی تهران، (P<0.001) نشان داد.

باریک داخل گرافی شیری سازی میدانهای طرفی و خلفی، با و بدون بلو بورد، تناسب زیستی و مقایسه داشت.

پانه‌ها ۲۱ میزان مایلین سن ۵۵ سال و نسبت مکانی به مون‌که ۲۲ یک درصد از آنها عمل جراحی اندومنیبرتیال (LAR) و ۸ یک روز عمل جراحی تحت‌ناری (APR) شده بودند. پس از این رضایت آگاهانه وارده این روش در بهترین میزان می‌باشد روه باریک بدرگردیده، مایلین مصرفی رده باریک بدرگردیده، مایلین مصرفی ۶۰ سانتی‌متر بزرگی ۲۰ میلی‌متر بزرگی و ۲۸ سانتی‌متر بزرگی ۴ مایلین می‌باشد.

رونه باریک در میدانهای طرفی و خلفی، از مایلین مصرفی APR (P<0.001) بوده و این (P<0.001) نشان داد.

تفاوت در میدانهای فلکی از لحاظ آماری به سطح قبل ملاحظه نرسید. تفاوت از آماری قبل ملاحظه، نوع عمل جراحی (LAR) در مقابل APR و اندوزه مایلین رادیوتراپی، اثر را ملاحظه نمودند.

Body-Mass index

کلمات کلیدی: سرطان پستان، رادیوتراپی BCCR
**ABSTRACT**

**Background:** We evaluated the efficacy of a simple belly-board device (BBD) designed and made in our department for reduction of small bowel inside the post-operative pelvic radiotherapy fields of rectal carcinomas.

**Methods:** A very simple BBD was designed and manufactured in our department. It was made of acrylic glass, and was 128 cm long, 40 cm wide, and 9 cm high, with a 25x25 cm square opening, the lower border of which was set to be positioned about 3 cm above patients’ iliac crest. Patients to be treated post-operatively for rectal cancers were simulated using oral contrast with and without the BBD for postero-anterior (PA) and lateral fields. The small bowel surface area (SBSA) inside the fields was measured and compared in the films with and without the BBD.

**Results:** Twenty-one patients, mean age 56 years, male-to-female ratio 2:1, 12 abdominoperineal (APR) and 9 low anterior resection (LAR), gave consent for this study. The mean SBSA were 7 and 13 cm$^2$ in the lateral fields and 29 and 60 cm$^2$ in the PA fields with and without the BBD, respectively (p = 0.001). The mean reduction in SBSA was 61% in the lateral fields, 53% in the PA fields, and 57% in both lateral and PA fields (p<0.001). The mean reduction in SBSA in lateral fields was 77% after LAR and 49% after APR (p=0.08). This difference was not significant for PA fields. The only factor with a significant effect was operation type (LAR versus APR) for reduction of SBSA in lateral fields (p=0.05). Gender, age, body mass index, and field sizes did not have a significant effect.

**Conclusion:** The simple BBD could significantly reduce the SBSA inside the pelvic radiotherapy fields of rectal cancers. This reduction seems more pronounced after LAR in the lateral fields, compared to APR.

**Keywords:** Breast cancer, radiotherapy
Evaluation of a simple BBD designed and made in our department for reduction of small bowel inside the post-operative pelvic radiotherapy fields of rectal carcinoma.

**INTRODUCTION**

Radiotherapy (RT) plays an important role in the treatment of pelvic cancers. For pelvic RT since acute and late small bowel toxicities are linked to the volume of small bowel exposed to irradiation, small bowel is the most important dose-limiting structure. Various surgical and non-surgical methods are used to reduce the volume of small bowel irradiation. Previous studies have shown that the prone position with distended bladder and belly-board device (BBD) reduces the volume of radiation to small bowel (1).

The purpose of our study reported here was to evaluate the efficacy of a simple BBD designed and made in our department for reduction of small bowel inside the post-operative pelvic radiotherapy fields of rectal carcinoma.

**METHODS**

A very simple BBD was designed and made in our department from acrylic glass, 128 cm long, 40 cm wide, and 9 cm high with a 25 ×25 cm square opening set to be positioned about 3 cm above the patients’ iliac crest (figures 1 and 2). All patients with rectal cancer treated by post-operative pelvic radiotherapy (concurrent chemoradiation) were eligible for this study. Informed consent was obtained from all patients. All patients were asked to empty their bladder after waking up and refrain from urination thereafter until the time of radiotherapy simulation in the morning. To identify the small bowel, 450 ml of oral contrast solution was given 1 hour before simulation. Orthogonal planar postero-anterior and lateral radiographs were taken on a conventional radiotherapy simulator in prone position, with and without the BBD.

First a PA radiograph was taken in prone position in full respiration while the arm was in an angle of 90° with the body. Second radiograph was taken in lateral view, both without the BBD. Third and fourth radiographs were taken in prone position in PA and lateral views with the BBD.

For all patients, planning target volume was defined in accordance with our departments’ protocols, treated by a PA and two lateral fields. External walls of small bowel opacified in each radiograph inside the fields were contoured and total small bowel surface area (SBSA) were calculated and compared for the films with and without the BBD.

To compare means, Student’s T-test was used. Univariate and multivariate analyses were performed using regression model to identify the relations between the parameters and reduction of SBSA inside the fields. A P-value of $\leq 0.05$ was considered significant.

**RESULTS**

Twenty-one patients (14 male, 7 female) with rectal cancer scheduled to receive post-operative pelvic RT were evaluated. The mean age was 56 years (ranging from 28 to 75). The mean time between operation and RT treatment was 13 weeks (ranging from 4 to 28). The mean height and weight was 163 cm (151-174 cm) and 65 kg (41-88 kg) respectively. The mean body-mass index (BMI) was 24.5 kg/m² (17–33 kg/m²).

Of these, 9 patients underwent low-anterior resection (LAR) before RT, while 12 patients received abdomino-perineal resection (APR). The mean lateral and PA field areas were 186 cm² (144–285 cm²) and 240 cm² (240–315 cm²), respectively.
Figure 1. The design of the simple belly-board used for this study, made from acrylic glass.

Figure 2. The simple belly-board designed and made in our department, in the simulator room.
The mean SBSA were 7 cm² ± 7 cm² and 13 cm² ± 10 cm² in lateral fields and 29 cm² ± 25 cm² and 60 cm² ± 28 cm² in PA fields with and without the BBD, respectively (P<0.001). The mean reduction in SBSA was 64% ± 38% in lateral fields, 56% ± 37% in PA fields, and 60% ± 29% in both lateral and PA fields (P<0.001).

The mean reduction of SBSA in lateral fields was 77% ± 24% after LAR and 49% ± 45% after APR (P=0.07). The mean reduction of SBSA in PA fields was 53% ± 35% after LAR and 54% ± 41% after APR (p > 0.1).

The volume of irradiated small bowel was similar in both genders. Also use of BBD was similarly effective to reduce the irradiated small bowel in both genders.

Multivariate and unvaried analysis demonstrated that gender, age, body mass index, field size, and time between operation and RT did not significantly affect SBSA inside the radiotherapy fields.

## DISCUSSION

For rectal cancers, small bowel is the dose-limiting structure for acute and chronic toxicity. The use of a BBD should improve the tolerance of aggressive combined modality treatment by reducing the small bowel volume within the pelvis compared to the prone position alone. The BBD provides an easy, economical, comfortable, and non-invasive technique to displace the small bowel from pelvic treatment fields (1). The volume reduction does not correlate with gender, age, weight, pelvic separation, and sequence of radiation treatment and surgery, as demonstrated in our study too.

The position in which a patient is treated for pelvic irradiation has been shown to have a dramatic significance with regard to the volume of small bowel within the treatment fields (2). Koelbl et al. undertook a prospective study to evaluate the influence of patient positioning (prone position using a BBD versus supine position) on the dose-volume histograms of organs of risk, and concluded that the prone position with a standard BBD should be the positioning technique for patients receiving adjuvant post-operative radiation therapy of rectal cancer (3). In another study they also evaluated the influence of three different BBD positions in radiotherapy of rectal cancer on the dose-volume histogram of the small bowel for 20 patients and showed that by placing the lower border of the BBD opening near the lumbosacral junction, both the volume of small bowel within the pelvis and the volume of small bowel within all tested dose levels were lower compared to its position near the symphysis or the lumbosacral junction (4).

Minimization of small bowel volume within treatment fields utilizing customized "belly-boards" has been studied by Shanahan et al (5). Thirty consecutive patients with pelvic malignancies were evaluated prospectively for the impact of a novel bowel minimization device ("belly-board") on the volume of small bowel included within a four-field pelvic radiation plan. A customized polyurethane and Styrofoam bowel immobilization mold was created for each patient in the prone position. The authors concluded that this device was comfortable, inexpensive, and highly reproducible, and permitted maximal bowel displacement from standard pelvic radiotherapy fields.

Some investigators argue that the advantages of the BBD regarding normal tissue sparing may be counteracted by problems of patient positioning. Allal et al. studied 23 patients with rectal carcinoma irradiated preoperatively and measured axis displacement in 14 patients treated without the BBD and nine with. No specific patient immobilization devices were used. They concluded that in patients treated prone for rectal cancer, the use of the BBD in the preoperative setting without immobilization devices was associated with problems of patient position reproducibility, particularly for the antero-posterior direction, and recommended the use of patient immobilization devices and/or individual custom-made BBD if a decision to treat the patient with a BBD is taken (6). Our study cannot help to clarify this matter, as all our patients were treated post-operatively.
In postoperative external beam radiotherapy of other pelvic cancers, treatment in prone position and an adequate bladder filling is important to reduce the irradiated bladder and bowel volumes (7), and it has been suggested that prone positioning on a BBD can reduce the small bowel dose further in gynecology patients treated with pelvic RT (8,9).

This study was limited by its relatively small sample size and the use of conventional 2-dimensional planning. CT simulation and dose-volume histograms could have shed better light on our study question, but this was hampered by limited access to this technique in our department at the time of the study.

In conclusion, the simple belly-board designed and made in our department significantly reduced the small bowel inside the pelvic radiotherapy fields of rectal cancers. This reduction seemed more pronounced after low-anterior resection in the lateral fields compared to abdomino-perineal surgery. The use of prone position and a belly-board device is recommended for all patients with rectal cancer irradiated post-operatively.

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REFERENCES


