

Prospective Study Comparing Wounds Closed With Tape With Sutured Wounds in Colorectal Surgery

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Hypothesis: To test the efficacy of adhesive paper tape in the closure of clean-contaminated wounds following elective colorectal resection.

Design: A prospective, nonrandomized controlled study.

Setting: A medical center that offers a mixture of primary, secondary, and tertiary care services.

Patients: The group undergoing skin closure with paper tape (PT group) consisted of 150 patients. The group undergoing skin closure with interrupted suture (IS group) also comprised 150 patients. All 300 patients underwent elective colorectal resection in 1997.

Main Outcome Measures: The duration of skin closure, wound complication rate, and cosmetic appearance of the scar at 6 months after operation were compared using the χ^2 test or *t* test.

Results: The mean \pm SD average duration of skin closure was 116 ± 23 seconds for the PT group and 457 ± 64 seconds for the IS group ($P < .01$). The wound complication rate was 3.3% (3 cases with wound infection; 2 with wound separation) for the PT group and 3.3% (5 cases with wound infection) for the IS group ($P = 1.0$). No significant differences were found between the narrowest width (mean \pm SD, 2.2 ± 0.9 mm vs 2.3 ± 1.0 mm) and widest width (mean \pm SD, 4.7 ± 2.0 mm vs 4.3 ± 1.8 mm) of scar formation between the 2 groups at 6 months after the operation. Ninety-eight percent of patients in the PT group reported satisfaction with their scar, compared with 92% in the IS group ($P = .03$).

Conclusion: Compared with the traditional suture method, paper tape closure in the treatment of clean-contaminated wounds was less time consuming and produced greater patient satisfaction with no increased rate of wound complications.

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INCISIONAL WOUND closures have traditionally been divided into the categories of thread and threadless sutures.¹ Linen strips were first used for the closure of wounds in Egypt in 1600 BC.² There has been a revival of threadless closure in recent decades. Wound closure with adhesive tape has several advantages over the use of sutures, including a less pronounced inflammation reaction (caused by suture materials), lower infection rates, no risk of abscess development at the location of stitches, and greater tensile strength when wounds are sutured late in the healing process (20-150 days).³⁻⁶ Additional advantages of taped skin closure compared with sutured skin closure include lower cost, reduction in operating room time, and improved cosmetic results.^{7,8} Although the scientific basis for selecting taped skin closure for abdominal wounds has been documented,⁹ the technique has not been widely used for this purpose. This may be due to fears of a wider scar, the weaker supporting strength of the tape, and/or an increased rate of wound complications, par-

ticularly in clean-contaminated wounds. Conolly et al¹⁰ reported a lower rate of infection for the taped wounds (3.8% vs 14% for the sutured wounds) in those patients with clean-contaminated wounds. In the study by Webster and Davis,² the infection rate for the taped wounds (11.1%) was higher than for the sutured wounds (8.4%). To test the efficacy of skin closure using paper tape in the clean-contaminated abdominal wound, we conducted this prospective study to compare taped with sutured wounds in terms of the duration of skin closure, wound complication rate, and cosmetic appearance of the scar at 6 months after operation.

RESULTS

No significant differences were found in age, sex distribution, diagnosis presence of ostomy, wound length, or thickness of subcutaneous tissue (**Table 1**). The duration of skin closure was significantly shorter in the PT group than in the IS group, and patient satisfaction with the scar appearance was significantly higher in the

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PATIENTS AND METHODS

A total of 300 patients who received elective colorectal surgery in 1997 were enrolled in the study. All operations were performed by 1 of 4 proctologists in the Colorectal Section. Patients were divided into 2 groups depending on the type of skin closure, which was performed according to the surgeon's preference. The group undergoing skin closure with paper tape (PT group) consisted of 150 patients operated on by 1 of 2 surgeons (H-H.C. and R.T.). The percutaneous interrupted suture group (IS group) was also composed of 150 patients operated on by 1 of 2 other surgeons (C-Y.Y. and J-Y.W.). All 300 patients received the same protocol of preoperative colon preparation and similar perioperative antibiotic prophylaxis.

The abdomen was opened via a transumbilical midline abdominal skin incision. All 300 patients were judged to have a clean-contaminated wound. On completion of the colon resection, surgeons approximated the fascial layer (rectus sheath and linea alba) using a continuous number 1 polydioxanone monofilament (PDS; Ethicon Inc, Somerville, NJ). In the PT group, sterile paper tape from 2 to 3 inches long was applied to accurately approximate the edge of the skin. If necessary, the assistant would apply pressure on both sides to help juxtapose the wound edges. The gaps between adjacent strips of paper on the wound surface were approximately 0.5 cm. We used 1-in strips of Micropore Hypoallergic Surgical Tape (3M Co, St Paul, Minn) that were sterilized with ethylene in the usual manner.

In the IS group, interrupted-silk sutures (Unik, Milwaukee, Wis) were used for skin closure. All of

the wounds were covered with a dry gauze dressing after closure.

After the operation, the wounds were examined every day. On the third postoperative day, the dressing was removed and the wound was observed. In the PT group, if secretion under the paper tape was thick or if peeling of the tape was noted, the affected tape was removed and immediately replaced at bedside with new sterilized strips of paper tape. The strips were retained in position for 7 to 10 days after the operation and were then carefully removed. In the IS group, the sutures were removed 7 days after the operation. If infection was detected, the paper strips or stitches were removed, and the wound was left open. Wet saline dressing was then applied and changed regularly.

The daily postoperative skin wound evaluation included checking for wound separation, peeling of tape, hematoma or obvious ecchymosis of the wound, blistering of the skin, skin allergy, and wound infection. Patients were asked if they experienced any painful sensations when the strips or sutures were removed and, just before discharge, if they were satisfied with the wound appearance. At 6 months postoperatively, the wound scar was reexamined, and its narrowest and widest portions were measured and recorded in millimeters.

Differences in the wound length, thickness of subcutaneous fat, time required for skin closure, and wound condition were compared using the χ^2 test or *t* test as appropriate. Univariate analysis of various skin closure groups was performed using the analysis of variance test. All tests were 2-sided. $P < .05$ was considered statistically significant. All analyses were performed using Statistical Product and Service Solutions Release 8.0 (SPSS Inc, Chicago, Ill) statistical software.

Table 1. Clinical Characteristics of Patients*

Characteristic	PT Group	IS Group
Age, mean \pm SD, y	59.5 \pm 14.1	58.7 \pm 15.2
Sex		
M	86	81
F	64	69
Diagnosis		
Cancer	139	138
Other†	11	12
Ostomy	17	19
Repeated operation	1	0
Wound length, mean \pm SD, cm	21.3 \pm 4.3	22.1 \pm 4.1
Height of fat, mean \pm SD, cm	1.9 \pm 1.0	1.9 \pm 1.3

*Data are presented as number of patients unless otherwise indicated.

PT indicates paper tape; IS, interrupted suture.

†Includes diverticulitis, chronic ulcerative colitis, ischemic colitis, familial adenomatous polyposis, colonic inertia, and presacral tumor.

PT group. Scar formation, assessed by the scar's narrowest and widest widths, was not significantly different among the 2 groups (**Table 2**).

Wound complications occurred in 5 patients (3.3%; 3 cases with wound infection and 2 with skin wound separation) in the PT group and 5 patients (3.3%; 5 with wound infection) in the IS group. No significant difference was found in the wound infection rate between the

2 groups ($P > .99$). Blistering of the skin (1 case) and mild allergic reaction of the skin (1 case) were noted in the PT group. An accumulation of wound secretion and loss of tape stickiness caused the peeling of tape in 14 cases (9.3%) in the PT group. After removal of the peeling tape and cleansing of the skin, the wound was reapproximated with new sterile strips of paper tape (the procedure took no more than 1 minute). None of the 14 patients with peeling tape developed wound infection.

COMMENT

The current study demonstrates that the efficacy of paper tape closure of abdominal wounds is greater than the suture method in patients undergoing colorectal surgery. The clinical comparison of tape and suture closure conducted by Conolly et al¹⁰ reported that the infection rate for taped wounds was significantly lower than for sutured wounds (3.8% vs 14%). In another clinical trial,² the infection rate of taped wounds was higher than that of sutured wounds (11.1% vs 8.4%) but did not reach the level of significance. Our data showed that the infection rate was not significantly different between the PT and IS groups. Taken together, these data suggest that wound infection may not relate to the material used for skin closure.

Table 2. Wound and Scar Outcomes in the 2 Groups*

Outcome	PT Group	IS Group	P
Wound			
Skin closure time, mean \pm SD, s	116 \pm 23	457 \pm 64	<.01
Painful removal, No. (%)	0 (0)	128 (85)	<.01
Wound complications, No. (%)	5 (3.3)	5 (3.3)	>.99
Scar			
Narrowest width, mean \pm SD, mm	2.2 \pm 0.9	2.3 \pm 1.0	.58
Widest width, mean \pm SD, mm	4.7 \pm 2.0	4.3 \pm 1.8	.12
Satisfaction with scar, No. (%)	147 (98)	138 (92)	.03

*PT indicates paper tape; IS, interrupted suture.

The present data show that the use of paper tape closure can overcome the disadvantages of percutaneous interrupted sutures, including the greater duration of skin closure,¹¹⁻¹² higher incidence of subcutaneous hematoma or ecchymosis, discomfort on removal of the sutures, and development of cross-hatching scars.^{2,13} In accordance with other studies,² our data also confirmed that a greater proportion of patients in the PT group were satisfied with their scar appearance at 6 months after the operation.

Paper tape closure has its own unique problems, most of which can be managed in the hospital. Webster and Davis² reported a 19% incidence of premature peeling of tape, which was not significantly related to wound infection in patients with a clean wound. They suggested that the peeling was caused by infection due to contamination during surgery rather than by bacteria entering the wound after operation. Premature peeling was readily dealt with by replacing the affected tape. None of the 14 cases with premature peeling had wound infection. These findings suggest that premature peeling can be caused by excess subcutaneous wet exudates and/or inadequate hemostasis rather than wound infection.

Separation of the skin is another problem following wound closure with paper tape. Several studies³⁻⁵ comparing tensile strength between taped and sutured wounds have demonstrated a greater strength in the taped wounds. However, uneven skin wound edge or extremely thick subcutaneous tissue may cause difficulties in skin approximation or with adhesive strips becoming less sticky, and hence may lead to a greater rate of skin wound separation in these patients. In the current study, 2 cases of skin wound separation occurred in the PT group. One patient was obese, and the other had a hypertrophic scar

from a previous laparotomy. The third potential problem with the use of paper tape is contact allergy, which may be caused by a specific tape ingredient.¹² The acrylate-based adhesive tape we used in the present study is hypoallergenic. In our PT group, only 1 patient (0.7%) had a mild allergic reaction.

In summary, the application of paper tape in uncomplicated skin wound closure following colorectal surgery is faster, more easily performed, and more cost-effective than the traditional suture method. It also makes removal of tape painless and leaves no cross-hatching scar. Some of the problems associated with this method (peeling of tape, wound separation, and allergy to tape) can be readily managed by removal or replacement of the paper strips.

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